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# AEROVAUTICAL INSPECTION DESCRIPTION

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A.I.D. Development Report

## Endurance tests on Flexible Wire Rope for

#### Aircraft Flying Controls

Ъу

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#### Summary

The programme of endurance tests on flexible wire rope for sircraft flying controls which were devised to assess the effects of different pulley sizes, cycling speeds, rope tensing and pulley wrap angles has now been completed. The results of all the tests (including those detailed in Interim Report No. AID/DEV/92/66) are given in this report. In addition a description is given of a new endurance test machine which has been developed for routine test work.

Approved by

C.P.L.I

on behalf of D.A.I.

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#### 1. Introduction

1.1 In 1962 a memorandum prepared by British Standard Institution Technical Committee ACE13 (Cables and Wire for Aircraft) indicated that it had been working on the revision of existing British Standards W.9 and W.11 for flexible wire ropes for aircraft controls and the preparation of a new standard for future use, on the lines most likely to be acceptable as an A.B.C. and world (I.S.O.) Standard. The Committee had also decided that both the revisions and the new standard should include an endurance test, since this is a requirement of the equivalent American and European (A.I.C.M.A.) standards and also because of the higher speeds and longer like (in terms of flying hours) of modern aircraft.

The results of a programme of work done on the endurance testing of wire ropes by Hawker Siddeley (Havilland Division) Ltd., under conditions closely similar to those obtaining in aircraft control circuits, indicated that the American and European (A.I.C.M.A.) endurance test is unrealistic in the light of modern aircraft installations. B.S.I. Technical Committee ACE/13, therefore, agreed on the principles of a new endurance test method and drew up a programme of tests to provide a basis for suitable test conditions which would more closely simulate actual operating conditions. A.I.D. Laboratories were requested to carry out the necessary development work to provide a suitable test for inclusion in the relevant British Standards and for submission to I.S.O., to A.I.C.M.A. and to the United States for possible world wide adoption.

1.2 In view of the foregoing, the work covered by this report was undertaken and while the primary objective was to provide a new endurance test, the programme of tests was also designed to provide the maximum amount of basic information on the behaviour of flexible wire ropes which would be useful to aircraft designers and wire rope manufacturers and users.

The complete programme of tests covered 27 varying test conditions, with at least 6 separate samples at each test condition. In August 1966 an interim report, number AID/DEV/92/66, covering the results of 6 of the 27 test series was issued. All the test series are detailed in this report.

1.3 The Flexible wire rope used for the whole programme of tests was specially manufactured, in a continuous 6,000 feet length, to draft British Standard Specification W.000 (now British Standard W.12). This length of rope was inch diameter and was lubricated during manufacture with Aeroshell GHRASE 14, anti-fret lubricant. (British Specification D.T.D.900/4609A, US specification NYLL-G-25537A, NATO Code No. 6-366). None of the samples used were pretreated in any way before testing.

#### 2. Description of Apparatus

2.1 The machine used for all the tests is illustrated at Photograph A and Figure 1 shows the wire rope circuit and pulley arrangements. Full details of the machine were given in Report No. AID/DEV/92/66. A second machine was built and used, identical with the first, except that it was fitted with a motor and reduction gear suitable for cycling speeds of 100 cycles per minute.

- 2.2 All the pulleys over which the rope was reciprocated were manufactured from steel heat treated to give a hardness of Hv.700 (Rockwell C.60 and ground to a fine finish of 32 micro inches C.L.A.; each pulley was mounted on standard self aligning ball bearing as used in aircraft control systems. Pulleys A, B and C were 4.5 inches in diameter and were used throughout the tests while pulleys D, E, F, G and H were either 2.25, 2.5 or 2.75 inches diameter as required by the test programme; these three diameters are equivalent to 18d, 20d or 22d, (where d is the nominal diameter of the rope under test). The rope groove in all 8 pulleys was 0.0672 inch (4 x 1.075) radius, ground to an envelope tolerance of ± 0.001 inch width.
- 2.3 Rope tension is monitored throughout each test by means of strain gauge weigh bars, Fig. 2., which are included in the rope circuit. The tension is measured at a central multipoint strain gauge bridge to an accuracy of + 1%.
- 2.4 Each machine has duplicate pulley systems so that 2 samples can be tested under similar test conditions simultaneously.

#### 3. Methods of Testing

3.1 The full programme of testing is given in Table 1 and this programme was arranged around a series of control values of pulley diameter, rope tension and cycling speed.

These control values were:-

Pulley diameter

2.5 inches (20d)

Rope tension

140 lb. (7% of the nominal breaking

strength of the rope)

Cycling speed

25 cycles per minute

The original programme called for alternative pulley diameters of 2.25 inches (18d) and 2.75 inches (22d), alternative rope tensions of 12% and 18% of the nominal breaking strength of the rope and alternative cycling speeds of 18 and 50 cycles per minute. The initial tests, however, indicated that cycling speed might not materially affect the results and in order that a saving in test time could be made, the first of the cycling speed alternatives was changed to 100 cycles per minute. It was also considered that this change might give a practical advantage when the final test conditions were evaluated.

- 3.2 For each type of test carried out, a minimum of 6 samples were tested and a length of approximately 21 feet was needed for each of these individual tests.
- 3.3 During the period of each individual test the machine was stopped a number of times for inspection of the rope-pulley centact areas. The extent of wear and the numbers of visible wires broken at each of the 5 pulley positions was recorded at each of these inspections. Tables 2 to 28 show the progression of wire failures for each test series. When more than 12 wire breaks were found at any one pulley position the test was discontinued.

- 3.4 At the conclusion of the endurance test programme the breaking strength of approximately a quarter of the samples was determined. Each sample was tested at the positions where it had been in contact with pulleys E, F and G and also at an undamaged section of the rope.
- 3.5 As detailed in Report No. AID/DEV/92/66, observations were made on the twisting effect as the rope passed over the various pulleys and on the degree of transverse slipping between the pulley surface and the rope. Records were also kept of angular pulley slip during each period between inspections.

#### 4. Test Results

the translatives in the street was a serious colory of the serious and the contra

- 4.1 Tables 2 to 28 show the number of visible wires broken during the course of each individual test in each of the test series. These details are listed separately for each of the 3 pulley positions E, F and G. The numbers of wire breaks at pulleys D and H were so few that only the totals at the end of each test are given. The information listed in these tables has been plotted graphically, in the form used in report No. AID/DEV/92/66 figures 2 to 19 and 22. It is considered, however, that to include the large number of graphs necessary to cover the whole programme would defeat the object of providing readily comparable values for all the variables involved. To overcome this difficulty a statistical analysis of all the results is being prepared with the assistance of the Mathematical Department, Royal Aircraft Establishment, and will be presented in Part 2 of this Report.
- 4.2 A series of residual breaking strengths from damaged sections of a number of the rope samples used in the programme, is given in Table 29 and these values, expressed as a percentage of the breaking strength of undamaged sections of the same reas, are shown graphically against numbers of visible broken wires in Figure 5.
- 4.3 As each test progressed it was found that the rope sample stretched slightly, this extension was measured and recorded at each inspection. The values noted for each of the series tested at 100 cycles per minute and at the three tension levels (i.e. test type numbers 1, 10 and 19; 4, 13 and 22; and 7, 16 and 26) are shown in Tables 30 to 38. All these extensions were collated into a series of intervals of numbers of cycles and are shown in Tables 39 to 41. The average extension for each interval was calculated and plotted against the logarithm of the mean number of cycles within each interval, this graph is shown at Figure 4.
- 4.4 As was mentioned in report number AID/DEV/92/66 an attempt was made to evaluate the amount of angular pulley slip which occurred during each test. Readings were taken, at each inspection, of the angular pulley movement relative to a datum point in the machine frame. In order to get a more detailed understanding of this movement, a series of time-lapse cine photographs were taken during the whole period of some of the tests. These photographs indicated a random movement, both clockwise and anti-clockwise, and one series even showed a reversal of direction during the test. The total amount of movement also varied considerably from a part of one revolution to several complete revolutions. In view of this evidence it was considered impossible to give accur to values for this slip and the figures recorded have been ignored.

#### 5. Discussion of Results

- 5.1 Part 2 of this report covers the effects due to variations of pulley size, rope tension and cycling speed as shown by a statistical analysis of the whole series. Comparative graphs have been plotted and these have confirmed that considerable increases in rope life can be obtained by small increases in the rope/pulley diameter ratios and, as might be expected, increased rope tension considerably reduces the rope life. An unexpected increase in rope life was found to result from an increase in cycling speeds.
- 5.2 The earlier report indicated that the most significant factor was the damaging effect of small wrap angle pulley/rope combinations. The wire wear and fatigue failure observed throughout the whole series of tests has confirmed this supposition as this damage has been confined almost exclusively to those pulley positions which have an angle of wrap of 15°.
- 5.3 At the conclusion of all the endurance tests, approximately a quarter of all the test samples were subject to tensile test to establish:-
  - (a) the breaking strength of an undamaged portion of the rope sample, and
  - (b) the residual breaking strength at each of the three pulley positions E, F and G.

As will be seen from Table 29 and Figure 3 there is no obvious relationship between the number of visible broken wires and residual breaking strength. In view of this a number of the broken samples which had given lit residual strengths were examined. This examination revealed that those samples which had been tested at the highest cycling speed and/or at the highest rope tensions exhibited wear, indentation and, in some instances, fatigue failure of the wires forming the central strand. During the early tests, which were all carried out at the lower cycling speeds and at the lowest rope tension, a similar examination of the samples which were tensile tested, gave no indication of wear or fatigue in the central strand.

5.4 The extension of the wire rope used in this series of tests would appear to be dependent on the number of reversals to which it is subjected and also to its tension. The pulley diameter, within the limits used in the tests, would seem to have virtually no effect on this extension. Extension values from all the tests carried out at 100 cycles per minute and at each of the three rope tensions were examined and it was found that this extension largely occurs in the early stages of testing and is directly proportional to the logarithm of the number of cycles undergone. Figure 4 shows this relationship for each rope tension. The greatest amount of extension noted was less than 0.15% of the original length of the rope sample.

Before installation in an aircraft control system, most wire ropes are pre-stressed to a load equal to approximately 60% of the nominal breaking load. As none of the test lengths of rope used in this programme have been subjected to this pre-stressing it cannot be assumed that the amount of extension noted will be completely similar to that which takes place during the working life of a control rope. The figures obtained, however, could provide designers and inspectors with a useful

/indication

indication of the percentage extension which might be expected at various stages of the life of any control system rope of similar size and construction to that used in these tests.

5.5 Time-lapse cinephotography and observation during the course of the various tests has established that some slipping occurs between pulley and rope, to a greater or lesser extent at all the pulley positions irrespective of the wrap angle, although it has not been possible to obtain reliable values for the amount of this slip. From the information which has been obtained, however, it would seem probable that this slip might contribute some slight wear to the rope surfaces in contact with the pulley.

### 6. Conclusions

6.1 As was reported earlier the most significant factor shown by these tests is the considerable amount of damage sustained by the rope where it passes over a pulley with a small wrap angle; furthermore, the only visible broken wires were those which had been in direct contact with the pulley and which showed considerable wear.

As a rope passes over a pulley the helical formation of its outer strands imparts to it a twisting action. Photographic evidence during the early tests showed that when the angle of wrap between rope and pulley is 900 or more, this twisting movement is quite smooth with no sign of superimposed movements transverse to the general direction of twist. Similar evidence from sections of rope adjacent to the 150 wrap angle pulleys shows this same twisting movement but, with a series of small movements superimposed, these are transverse to and in the reverse direction to that of the general twisting novement. These movements can be directly related to the number of strands passing over the pulley. would appear that with these small wrap angle conditions the rope twists but, at the points where each strand passes over the pulley and when the friction between rope and pulley is at a minimum, a small amount of the twist is released. The rope thus passes over the pulley in a series of twists and partial releases, these movements are considered to be directly responsible for the rapid wear of the wires which are in direct contact with the pulley surface. The greater contact area of the 90° wrap angle pulleys no doubt restrains this reverse movement and could account for the very few wire breaks observed at these pulley positions. been hoped to carry out further work to completely investigate this mechanism of wear and subsequent fatigue failure but this has not yet been possible.

6.2 Although the early tests had indicated that this method of endurance testing would tend to confine the wire failure to the external contact surfaces of the rope the later tests have shown that this supposition is not true for all the various conditions of test involved by the programme.

Examination of many more of the endurance test samples will be necessary to obtain precise information of the conditions of test which produces fatigue failure of surfaces wire only and of those conditions which result in both external and internal wire damage and failure. The information so far available suggests that an acceptance criterion should be based on residual strength, as in the American specifications, rather than on numbers of visible wire breaks.

6.3 This programme of tests has completely confirmed that both the pulley/rope diameter ratio and the rope tension have a very critical effect on the endurance life of the wire rope. Although no hard and fast minimum values for all sizes and constructions can be formulated without more experimental work it is considered that pulley/rope diameter ratios below 20 and rope tensioning loads greater than 7% of the specified nominal breaking load should be avoided in control system design.

6.4 Because of the many combinations of test conditions which had to be met by the programme, and in order to obtain a useful amount of information in the shortest time, only one size of rope was tested. In view of this limitation it is not yet possible to specify final test conditions which could be incorporated in the relevant British Standards.

The statistical analysis detailed in Part 2 of this report (due for publication in approximately 6 weeks time), provides information for tentative recommendations for the test conditions which could be expected to give the most consistent endurance values with a test duration comparable with existing methods. The conditions are being included in the current test programme and it is expected that the additional information required for more definite recommendations should be available within the next 12 months.

6.5 Although the work covered by this report has not yet resulted in concrete proposals for an endurance test which could be included in the British Standard Specification for flexible wire ropes for aircraft flying controls it has provided a new test method which is considered to be more realistic than existing methods and it has also provided information on the behaviour, under conditions similar to those in an aircraft circuit, of wire rope which should be very useful to aircraft lesigners and wire rope manufacturers.

#### 7. Further Work

7.1 The whole programme of testing detailed in this report was carried out on the machines built to the original design described in Report No. AID/DEV/92/66 and, as was envisaged in this report, these machines have proved very successful for this type of research programme. Further work to evaluate test parameters for other rope sizes and constructions and to determine the effects on rope life of coating pulley surfaces with non-metallic materials is contemplated. However, as this machine design is not considered to be suitable for production testing, a new machine has been designed and built and is illustrated at Photograph B and Figure 5. This machine, while still simulating the more severe conditions likely to occur in aircraft control systems, is compact and can test 8 comparatively short rope samples at any of the various conditions of test likely to be suggested for inclusion in the specifications.

Preliminary tests have shown that the pattern of wire wear and mode of failure produced by the new machine is very similar to that produced by the original machines. A new programme of testing has been started with this new equipment to establish that the results obtained are comparable with those obtained in the original machines.

TABLE 1

PROGRAMME OF TESTS ON A IN. DIA. CARBON STEEL WIRE ROPE

TEST TYPE NO.	ROPE SIZE	PULIEY DIA. D. IN.	STROKE  ± $\frac{2}{3}$ D.	RATE OF CYCLING cycles/min.		ension 1b.1 e of Break	
1234567890112345678901234567		2.25 "	1.50 "" "" " 1.67 " " " " " " " " " " " " " " " " " " "	100 25 50 100 25 50 102 50 25 100 25 50 25 50 25 50 25 50 25 50 25 50 25 50 25 50 25 50 25 50 25 50 25 50 25 50 25 50 25 50 25 50 25 50 50 50 50 50 50 50 50 50 50 50 50 50	140	240	

TABLE 1

Sample No. 2  Sample No. 2  No. of Visible Wires  3 4  4 8  4 8  5 13  5 15  5 15  6 16  Sample No. 5  10 0 0 Visible Wires  8 4  7 4  4 7  4 7  4 7  7 6  4 4  5 15  5 15  5 15  5 15  6 16  8 8 6  5 6  5 6  6 6  6 7  7 1  8 8 6  5 6  5 6  5 6  6 7  7 1  8 8 6  5 8  5 8				Progression of	1	Visible Wire Failures	ilures	· ************************************		F 4 4 5 6	ł	
Sample Nc. 1   Sample No. 2	ling Spee	of 10		cles/Min.				+1	1.50 .Inches	Pulley Dia	ameter	2.22. [nelies
State   No. of Visible Wires Broken         Cycles         No. of Visible Wires		Sampl	Nc.			Sample	No.			Sample	No. 3	erver ( merebener ) and construct of the
ted Pullcy E Pulley F Fulley G completed Pull   0 0 0 2 25,0000 2   0 0 1 4 45,000 3   1 1 5 55,000 4 4 45,000 5   2 3 12 75,000 5   2 4 13 85,000 5   2 4 13 85,000 5   8 No. of Visible Wires Broken   0 2 3 55,000 6   2 3 25,000 6   2 3 25,000 5   2 3 25,000 5   2 3 25,000 5   2 3 25,000 5   2 3 25,000 6	<u>-</u>		sible Wire	s Broken	Cycles	of	e	s Broken	30[04]	No. of Vi	Visible Wires	s Broken
0		ullsy E		•	completed	Pulley E	3	Pulley G	completed	Pulley B	Pulley F	Pulley 6
0   1   5   55,000   1   1   5   55,000   1   1   5   55,000   1   1   2   25,000   1   2   2   25,000   2   2   2   2   2   2   2   2   2	000	0	0	2	25,000	2	3	1	25,000	2	1	3
0   1   4   45,000   1   1   2   55,000   4   4   45,000   4   4   45,000   4   4   45,000   4   4   45,000   5   5   5   5   5   5   5   5   5	000	0	1	3	35,000	3	77	4	45,000	3	2	3
1   1   5   55,000   4     2   3   12   75,000   5     2   4   13   85,000   5     2   4   13   85,000   5     2   4   13   85,000   5     Sample No. 4   105,000   6     Sample No. 4   105,000   6     Sample No. 4   105,000   6     2   3   5   50,000   6     3   3   5   50,000   5     4   5   5   5   5     7   6   8   65,000   5     7   6   8   65,000   5     7   6   8   65,000   5     7   6   8   65,000   5     7   6   8   65,000   5     7   6   8   65,000   5     7   7   6   8   65,000   5     7   8   11   85,000   5     8   11   85,000   5     8   11   86,000   5     8   11   8   11   8     8   11   8     8   11   8   11   8     8   11   8   11   8     8   11   8   11   8     8   11   8   11   8     8   11   8   11   8     8   11   8   11   8     8   11   8   11   8     8   11   8	000	0	1	4	75,000	3	9	4	55,000	4	3	
1	000	-	1	5	55,000	7	7	4	75,000	4	4	3
2 4 13 85,000 5 2 4 13 85,000 5 3 28mple No. 4 3 No. of Visible Wires Broken Cycles Pulley F Pulley G Completed Pull 2 3 5 5,000 5 2 3 5 5,000 6 2 3 5 5,000 6 2 5 5 7 55,000 5 2 7 6 8 65,000 5 2 7 6 8 65,000 5 2 7 6 8 65,000 5 2 7 6 8 65,000 5 2 7 6 8 65,000 5 2 7 6 8 65,000 5 2 7 6 8 65,000 5 2 7 6 8 65,000 5 2 7 6 8 65,000 5 2 7 6 8 65,000 5 2 7 6 8 65,000 5 2 7 6 8 65,000 5 2 7 6 8 65,000 5 2 7 6 8 65,000 5	000	-	44	6	65,000	ተ	8	4	85,000	4	9	3
2	000	2	3	12	75,000	5	12	9	95,000	4	8	3
Sample No. 4   105,000   6     Sample No. 4	800	2	4.	13	85,000	5	13	8	107,000	5	8	3
Sample No. 4       105,000       6         Sample No. 4       Cycles       No.         Led Pulley E       Pulley E       Pulley G       Completed       Pull         2       3       25,000       2         2       3       5,000       5         3       5       45,000       5         7       6       8       65,000       5         7       6       8       65,000       5         7       6       8       65,000       5         7       6       8       65,000       5         7       6       8       65,000       5         8       11       85,000       5					95,000	5	15	6	117,000	7	6	7
Sample No. 4         No. of Visible Wires Broken       Cycles       No.         ted       Pulley F       Pulley G       Completed       Pull         2       3       25,000       2         2       3       5,000       45,000       5         3       5       7       55,000       5         7       6       8       65,000       5         7       6       8       65,000       5         7       6       8       65,000       5         7       6       8       65,000       5         7       6       8       65,000       5         8       11       85,000       5	-				105,000	9	16	12	148,000	13	6	9
No. of Visible Wires Broken         Cycles         No.           completed         Pulley F         Pulley G         Completed         Pull           2         3         25,000         2         2           2         3         5,000         4           3         5         5,000         5           5         5         7         55,000         5           7         6         8         65,000         5           7         6         8         65,000         5           7         6         8         65,000         5           7         6         8         65,000         5           7         6         8         65,000         5           8         11         85,000         5		Sample				Sample	No.			Sample 1	No. 6	
bed Pulley B           2         3         25,000         4         1           3         5         45,000         5         1           5         5         7         55,000         5         4           7         6         8         65,000         5         6           7         6         10         75,000         5         6           7         6         10         75,000         5         8           13         8         11         85,000         5         9			sible Wire	s Broken	Cycles	! 1	sible Wire	s Broken	Cvcles	No. of Wisible	sible Wires	s Broken
0         2         3         25,000         2           2         3         5         35,000         4           3         5         45,000         5           7         6         8         65,000         5           7         6         10         75,000         5           13         8         11         85,000         5		illey E	Pulley F		completed			Pulley G	completed	Pulley B	Pulley F	Pulley G
2     3     5     35,000     4       3     3     5     45,000     5       7     6     8     65,000     5       7     6     10     75,000     5       13     8     11     85,000     5	000	0	2	3	25,000	2	0	1	35,000	2	2	-
3         5         5         45,000         5           5         5         7         55,000         5           7         6         8         65,000         5           7         6         10         75,000         5           13         8         11         85,000         5	000	2	3	5	35,000	4	+	2	1,5,000	CV.	3	1
5         5         7         55,000         5           7         6         8         65,000         5           7         6         10         75,000         5           13         8         11         85,000         5	000	3	3	5	45,000	5	+	3	65,000	- 17	3	+
7         6         8         65,000         5           7         6         10         75,000         5           13         8         11         85,000         5	8	5	5	7	55,000	2	4	4	85,000	٥	. #	2
7         6         10         75,000         5           13         8         11         85,000         5	080	7	9	8	65,000	5	9	5	95,000	හ	5	~
13 8 11 85,000 5	80	7	9	9	75,000	5	8	5	115,000	10	9	5
ų	8	13	8	11	85,000	5	6	9	126,000	11	9	9
2	+				95,000	ħλ	1.1	7	136,000	11	7	6
105,000 5 13					105,000	5	13	7	146,000	12	7	10

		er 2.25 Inches		W. w.	LITE	y F Pulley G			***************************************								B. C.	Tree proken	F Pulley 6								
		Diamet	No.	of Visible	arorer	Pulley										No.	ع ا		Pulley		test.						
		Bulley Diameter	Sample	No of T		Fulley E										Sample No.	No. of V:		Pulley E		end of						
	1.50	••••Inches			- Cycles													Cycles completed			broken at						
	Stroke +			es Broken	Pyllow 2												s Broken		5 Karrns		1 Wire						
Patlimos			e No.	Visible Wires	Pullev F											No.	Visible Wires	ם מסררים			ruttey H,						
Visible Wire Reilung	Tension14	•	әтфшес	No. of	Pulley E											Sample	No. of Vi	Pulley E			7						
· 1				Cycles	completed												Cycles	completed									
Progression of	Cycles/Win.			s Broken	Pulley G	3	3	3	7	7	9	6	ę	13			Broken	Pulley G	8	7-1-	12	15	16	17	18	19	20
	100	le No. 7		of Visible Wires	Pulley F	2	7	5	7	15	19	23	24	56		S NO. 8	of Visible Wires Broken	Pulley F	2	7	4	7	8	10	11	12	12
	peed	Sample		ġ	Pulley E	+-	5	8	10	12	12	12	13	15		,	No. of Vis	Pulley E	-	1	+	4-	1	1	2	3	3
	Cycling Speed			Cycles	completed	25,000	35,000	146,000	55,000	65,000	75,000	85,000	95,000	105,000			············	completed	25,000	35,000	45,000	55,000	65,000	75,000	85,000	95,000	107,000
LA	BS/20/	/68						<del></del>		I.		L		l	<b></b>	ــــــــــــــــــــــــــــــــــــــ	<del></del>			TAB:	Œ:	2 (	Con	tā.	.)	l	

BLE 2 (Contd.)

			Progression of	1	Visible Wire Feilures	ilures			Test Type	2	
Cycling S	peed.	Cycling Speed25 Cycles/Min.	cles/Min.	Rope Tension		1481b. Stroke -		150 Inches	Pulley Diameter		2.25 Inches
	Sample	e No. 1			Sample	No. 2			Sample	No. 3	
Cvcles	No. of Vi	of Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken	Cvcles	No. of Vi	Visible Wires	s Broken
completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley 3
1,800	0	0	0	13,600	1	ţ	0	16,300	4-	1	0
14,875	0	0	0	23,380	2	2	0	22,880	1	2	-
24,540	2	0	2	31,730	9	9	0	30,770	3	3	-
36,430	5	1	3	41,080	10	6	3	38,050	7	5	2
48,500	13	5	5	62,790	19	15	10	47,340	8	ဆ	3
								54,060	14	11	ຜ
									_		
	Samp],	Sample No. 4			Sample No.	No. 5			Sample No.	No. 6	
Cycles	No. of Vi	of Visible Wires Broken	s Broken	Cycles	No. of Vi	Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken
completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley B	Pulley F	Pulley 0
1,900	0	0	0	12,460	0	0	0	16,300	0	2	•
12,290	0	O	0	22,230	પ્ર	0	-	22,880	0	4	-4
24,540	0	~	4	30,610	6	-	5	30,770	-	æ	3
36,430	5	5	7	39,970	12	-	5	38,050	4	12	14
48,500	6	Qi-	8	61,680	16	5	15				
56,370	11	16	40								
	SAMPLE 1.	Pulley H,	1 wire	broken at end	of test.						
	SAMPLE 4.	Pulley D,	2 wires broken	oken at en	of test.						
And desirated, product designs where we're											

Progression of Visible Wire Fallures   Pauluce   Paulu		2.25		B:roken	Pulley G	0	0	6	-						Broken	Pulley G	С	0	20					-
Sample No. 4   Sample No. 5   Sample No. 5   Sample No. 6   Sample No. 6   Sample No. 7   Sample No. 7   Sample No. 6   Sample No. 7   Sample No. 6   Samp				1	FH	_	-	-	-	 	-	-				E		-	-	_		-		1
Sample No. 1   Sample Wires Ballures   Pallures   Pal	8	iameter	1		Pulley	2	9	14						i	1	Pulley	-	3	.7					
Progression of Visible Wire Failures	Test Type			of	1	-	5	12						Sample 1	of	1	-	3	10					<b>*</b>
Sample No. 1   Sample Wires Broken   Oyoles   Sample No. 2   Sample No. 1   Sample No. 2   Sample No. 1   Sample No. 2   Sample No. 1   Sample No. 2   Sample No. 2   Sample No. 4   Sample No. 6   1   3   46,700   4   3   3   3   3   3   3   3   3   3		SoInches		30,040	completed	30,060	55,980	81,898							Cvcles	completed	30.060	55,980	81,898					<u> </u>
Sample No. 4   Sample Wires Broken   Cycles   Pulley E   Pulley E   Pulley E   Cycles   Pulley E   Pulley E				ī	ł	3	3	6	10								7	7	14	23				÷
Progression of Visible   Pesd   Progression of Visible   Pesd   Pulley E	ilures	9lb. Str	No.	1		1	3	8	14					No.			-	3	7					
Pesd 50 Cycles/Min. Rope   Sample No. 1   Cycles/Min. Rope   Sample No. 1   Cycles/Min. Rope   1   1   0   27,7     1			Sample	of	i	0	4	5	14					Sample	No. of	Pulley	0	†	10	19	of test.	$^{0}$		
Pead50 Cycl Sample No. 1  No. of Visible Wires  1 1 1  6 1 6  7 2 2  7 8  No. of Visible Wires  No. of Visible Wires  Pulley E Pulley F P  1 4  1 4  1 4  2 11  2 11  4 5  SAMPLE 1. Pulley H, SAMPLE 4. Pulley D,	2			Cycles	completed	27,790	7002,947	62,090	103,260				_		Cycles	completed	27,790	002,94	060,79	103,260		at	oken at end	
No. Pull SAMP SAMP SAMP SAMP SAMP SAMP SAMP SAMP	Progressi	cles/Min.		, ,		0	3	7	1,4						s Broken		و	6	13	19	1 wire br		1 wire	
No. Pull SAMP SAMP SAMP SAMP SAMP SAMP SAMP SAMP					Pulley F	-	-	2	8								7	3	77	15		Pulley		
es eted 2005 44 44 44 65 65 65 65 65 65 65 65 65 65 65 65 65		pead	Sampl			-	9	Ş	15					Sampl	No. of	Pulley	-	••	2	47		SAMPLE 4.	6.	
Cycli Cycl Cycl Cycl Cycl Cycl Cycl Cycl Cycl		Cycling S		Cvcles	completed	38,605	50,790	64,790	78,114						Cycles	completed	38,605	50,730	64,790	78,114				

TABLE 4

Rope Tension of Visible Wire Fullures  Rope Tension		····	1	T		1	Τ	T						[ ]			1				
Rope Tension140lb. Stroke t1.50.Incher Pulley Diameter  Sample No.  Cycles  Cycles  Pulley B Pulley C Cycles  Cycles  Pulley B Pulley C Cycles  Cycles  Pulley B Pulley C Cycles  Sample No.  Sample No.  Cycles  No. of Visible Wires Broken  Cycles  No. of Visible Wires Broken  Cycles  Bulley B Pulley C Cycles  Cycles  Sample No.  Cycles  Pulley B Pulley C Cycles  Roompleted  Pulley B Pulley C Cycles  Cycles  Roompleted  Pulley B Pulley C Cycles  Pulley B Pul	1:	25. Inches			Pulley G									Pulley G							
Rope Tension 1401b. Stroke to 1450.Incher Pul Sample No. of Visible Wires Broken Cycles Cycles Cycles Cycles Cycles Cycles Completed Pulley E Pulley F Pulley G Cycles Completed Pulley E Pulley F Pulley G Pulley Bulley G Cycles Completed Pulley E Pulley F Pulley G Cycles Completed Pulley E Pulley F Pulley G Cycles Cycles Completed Pulley E Pulley F Pulley G Cycles Completed Pulley F Pulley G Cycles Cycles			.o.	1								.0	sible Wire								
Rope Tension140lb. Stroke t1.  Sample No.  Cycles  Cycles  Cycles  Pulley E Pulley F Pulley G  Sample No.  Cycles  Cycles  Cycles  Cycles  Cycles  Ro. of Visible Wires Broken  Cycles  Cy	Test Type	Pulley Di	Sarple 1	of															•		
Rope Tension140lb. Stroke :  Sample No. Cycles Cycles Pulley E Pulley F Pulle Sample No. Sample No. Cycles Completed No. of Visible Wires Brok Cycles Completed Pulley E Pulley F Pulle		oo.Inche		Cvoles	completed								Cycles	completed							
Rope Tension Cycles Completed Cycles				1 .										1							
Rope Tension Cycles Completed Cycles Completed Pu Cycles Cycles Cycles Cycles Cycles Cycles Cycles Cycles Cycles	ilures	lb. Stro	No.	1 3								No.	sible Wires								
Rope Cyo compl	le Wire Fa		Sample	of								Sample									of test.
Ogressi Min. Min. Oken Oken 12 5 5 5 5 5 5 5 5 5 5 7 12 12 12 12 12 12 12 12 12 12 12 12 12	of			Cycles	completed								Cycles	completed							en at end of
	Progressi	les/Win.		Broken	Pulley G	-	2	5	5				Broken	Pulley G	5	8	12	15			1 wire broken at
Sample No. 7  of Visible Wires Broken ey E Pulley F Pulley G 5 6 6 5 6 6 5 13 13 5 13 5 14 3 6 6 5 13 14 3 6 6 5 13 14 5 6 6 5 14 3 6 6 5 6 6 5 6 6 5 6 6 5 6 6 5 6 6 5 6 6 5 6 6 5 6 6 5 6 6 5 7 1 5 6 6 6 7 1 5 6 7 8 6 7 8 7 8 7 9 8 7 9 8 7 9 8 7 9 8 7 9 6 15 8 9 7 9 9 6 15		Cyc	No.			0	4	9	13			,	sible Wires		1	3	77	9			
			Sample	of	Pulley	3	5	9	13			Sample	No.	Pulley	2	9	9	9			SAMPLE 7. Pulley H,
Cycling Speed Cycles No.  Cycles Completed Pul.  31,015  51,246  80,561  31,015  51,242  61,246  80,561  30,561		Cycling S		Cvcles	completed	31,015	51,242	61,246	80,561				Cycles	completed	31,015	51,242	61.246	80,561			

TABLE 4 (Contd.)

			Progression of	•	Visible Wire Pailures	ilures					
		0			,				rest Type		•
Cycling 5	speed	Cycling Speed 100 Cycles/Min.	cles/Min.	Rope Tension		240lb. Stroke ±		1.50. Inches	Pulley Diameter		2:25.Inches
	Sampl	Sample No. 1			Sample	No. 2			Sample No.	No. 3	
Cycles	No. of Vi	of Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken	80 (04)	No. of Vi	Visible Wires	s Broken
completed	Pulley B	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley B	Pulley F	Pulley G
15,000	2	2	5	15,000	1	0	1	20,000	2	2	Ą
30,000	2	2	5	25,000	3	1	5	30,000	7	2	11
31,000	4	4	9	30,000	3	3	7	37,000	5	8	15
43,000	15	8	14	000*01	7	8	6				
				50,000	13	13	13				
						•					
	Sampl	Sample No. 4			Sample	No. 5			Sample No.	No. 6	
Cycles	No.	of Visible Wires Broken	s Broken	Cycles	No. of Vi	Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken
completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
11,000	+	τ-	1	15,000	1	4	4	15,000	0	1	5
15,000	2	-	-	25,000	9	8	10	20,000	0	3	7
25,000	5	-	3	30,000	6	10	19	31,000	2	5	8
34,000	10	11	7					43,000	5	7	12
41,000	19	19	12								
											j
	***************************************	-		\$							

TABLE 5

		8 8	T	7	ü	c)	T	T	T	T	T	T	T	T	T	T			ر	T	T	7	T	T	7		<b>r</b>	Τ	T
9		25. Inc.			es Eroken	Pulley	-		•	9	8	12		İ				s Broken	Puiley	•		> 0	5	F ] :	\   	9			
TABLE	Je 5	ameter	Me. 7	NC. 2	Visible Wires	Pulley F	0	~	,	4	7	14				3	No. 6	Visible Wires	Pullev F		~	7		.   c		13			
	Test Type	Puiley I	Comple	Ardimor	No. of Vi	Pulley E	2	5	80	12	14	16					Sample 1	No. of Vis	Pulley E		100	2	4	*	*   *	9		<b></b> :	
		1.50 Inches			Cycles	completed	10,000	14,000	18,000	22,000	26,000	30,000						Cycles	۳.	10,000	14,000	18,000	22,000	26.000		30,000			
		Stroke - 3.5			ss Broken	Pulley G	Ø	1	1									s <i>b</i> roken	Pulley G	4	12	14		-	+	+			
	Failures	240lb. St	e No. 2		or visible Wires	Pulley F	5	బ	16							2	2	Visible Wires	Pulley F	9	6	14							
		• 1	Sample		NO. OF V	Pulley E	~	7	ထ							Comple	o de la companya de l	No. of Vi	Pulley E	2	3	3							
19	ion of Visible	Rope Tension			Cycles		17,000	21,000	23,000									Cycles	comple ted	17,000	21,000	23,000					+		1
	rogression	cles/Min.		3 Broken		talley 6	7	0	77									Broken	Pulley G	2	7	80				<u> </u>		+	1
		Cycling Speed Cycles/Min.	Sample No. 1	of Visible Wires	ם יינים	J Korran			13							e No. 4			Puiley F		3	27	1						1
	, ,	Speed	Samp	No. of Vi	12.8		, ,	3 9	97							Sample No.	No of the		2	~	?   ?	#					-		1
				ָ ֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֓֞֞֞	completed	15.000	22.000	27.000					***************************************					Cycles ccmpleted		12) CO	27,000	200							7
	TAB	LB 6										.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,						····		<u> </u>		_l					L	L	J

			Promotesion of	-	Itaihle Wim Beilmen	£ 7	-				
			200		DI BYTH OTO	CASTO			Test Type	^	•
Cycling	Cycling Speed	Cy	Cycles/Winc	Rope Tension	ion 2401b.		Stroke	50 Inches	Pulley D	Diameter <sup>2</sup> :25.	5. Inches
	Sample	Le No. 7			Sample	No.			Sample	No.	
Gyo] es	No. of Vi	of Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken	a o Lov	No. of Vi	of Visible Wires	s Broken
comple tel	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley K	Pulley F	Pulley (2
9,000	0	0	2		SAMPLE 7	1	D, 1 Wire	broken at	nd of test		
38,000	21	21	36			) Pulley	1 Wire	at	8		
					SAMPLE 8	) Pulley	1	broken at	and of test		
							H, 2 Wires	broken at	ä	t.	
											7
	Sampl	Sample No.8			Sample	No.			Sample No.	No.	
Cycles	No. of Vi	of Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken	Cvcles	No. of Vi	Visible Wires	s Broken
completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pull.ey G
6,000	1	0	0								
38,000	23	13	13								
								٠			

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TABLE 6(Contd.)

TABLE 6 (Contd.)

TA			Progression of		Visible Wire Failures	ilures			Test Type	e 6	
Cycling Speed		50 Cycles/Min.	cles/Min.	Rope Tension	on .240lb.	lb. Str	Stroke - 1.	1.50 Inches	Pulley D	as a	%.Irches
	Sampl	Sample No. 1			Sample	No. 2			Sample	No. 3	
Cvcles	No. of Vi	of Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken	so Long	No. of Vi	Visible Wires	Brcken
completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
14,000	4	1	2	14,000	3	3	-	15,000	1	8	c
21,000	9	1	3	20,000	3	8	2	20,000	2	6	c
28,000	11	9	4	26,000	5	10	3	25,000	3	11	O
31,000	15	7	7	31,000	9	12	4	30,000	5	12	, <b>:</b>
	2										
	Sampl	Sample No. 4			Sample No.	No. 5			Sample	No. 6	
Cycles	No. of Vi	of Visible Wires	s Broken	Cycles	No. of Vi	of Visible Wires	s Broken	Cycles	No. of Vi	of Visible Wires Broken	s Broken
completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
14,000	0	0	2	15,000	H	ר	0	15,000	3	0	<b>,</b> 1
22,000	1	4	4	20,000	3	5	2	20,000	5	0	2
30,000	2	5	4	25,000	9	7	4	26,000	7	0	4
37,000	7	ಐ	6	30,000	8	8	9	31,000	L	1	ĸ٦
43,000	8	12	12	35,000	13	8	11	36,000	8	5	7
								42,000	13	9	15
SAMPLE 1,		3 wires	broken at	l of		•					
	Pulley	l wire	broken at	nd of test.							
SAMPLE 6,	Pulley	D, 1 wire	wire broken at	end of test							
	***************************************				£		A	T			

	2.25 Enches		s Broken	Pulley G	1	3	7	11	14				s Broken	Pulley G	٥	0	4	ထ	6		
7	iameter	No. 3	Visible Wires	Pulley F	2	3	7	10	14			No. 6	Visible Wires	Pulley F	7	1	5	15	21		
Boot B	Pulley Diameter	Sample No.	No. of Vi	Pulley E	1	3	5	7	10			Sample	No. of Vi	Pulley E	0	0	1	11	12		
	1.50 Inches		Corles	completed	8,000	12,000	18,000	26,000	31,000				Cvcles	completed	8,000	12,000	18,000	26,000	31,000		
	Stroke - 1.5		a Broken	Pulley G	2	5	L						s Broken	Pulley G	7	11	1.9				
ilures	360lb. Str	No. 2	Visible Wires	Pulley F	3	6	10					No. 5	of Visible Wires	Pulley F	4	8	1,1				
Visible Wire Failures	1	Sample	No. of Vi	Pulley E	2	5	15					Sample No.	No. of Vi	Pulley E	2	લ	2				
	Rope Tension		Cycles	completed	9,000	13,000	17,000						Cycles	completed	9,000	13,000	17,000				
Progression of	••• Cycles/Win.		s Broken	Puiley G	0	0	5						Broken	Pulley G	7	7	77				
		e No. 1	Visible Wires	Pulley F	8	8	15					e No. 4	of Visible Wires	Pulley F	2	~	7				
	201	Sample	No. of	Pulley E	0	0	1					Sample No.	No.	Pulley E	0	0	7				
	Cycling Speed		Cycles	completed	10,000	13,000	18,000						Cycles	completed	10,000	13,000	18,000				

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TABLE 8

TABLE 8

6)

				Progression of	1	Visible Wire Failures	ilures			E +	8	
Sample No. 1   Sample No. 2   Sample No. 5   Sample No. 5	ycling S	25,	Cyc	cles/Win.		360 no	lb. Str	oke + 1.50	) Inches	rest 1yp Pulley D	e	25. Inches
No. of Visible Wires Broken   Cycles   No. of Visible Wires Broken   Cycles   Pulley E   Pulley E		Sampl	i i			Sample	No.			Sample	l	
Pulley E         Pulley F	Cvcles		sible Wire		Cycles	of	Ŧ ,		Cvcles	a .	sible Wires	s Broken
1   1   2   10,000   3   5   2   10,000   2   2   1   1   1   1   1   1   1   1	completed		Pulley F	Pulley G	completed			Pulley G	completed		Pulley F	Fulley G
5   6   10   15,000   21   10   4   15,000   5   11	10,000	1	1	2	10,000	3	5	2	10,000	2	3	Ĉ
14   10   17   19,000   21   10   4   18,000   6   11   12   12   13   13   13   14   19,000   11   12   13   14   19,000   11   12   10,000   11   12   10,000   11   12   10,000   11   12   10   12   10,000   11   12   10   12   10   12   10   12   10   12   10   12   10   12   10   12   10   12   10   12   10   12   10   12   10   12   10   12   10   12   10   13   14   15,000   11   12   10   15,000   11   12   10   15,000   11   12   10   12   12	15,000	5	9	10	15,000	11	7	5	15,000	5	8	4
Sample No. 4t   Sample No. 6t   Sample No. 6	18,000	14	10	17	19,000	21	10	4	18,000	9	11	5
Sample No. 4,   Sample No. 5   Sample No. 6   Sam									21,000	10	12	10
Sample No. 4   Sample No. 5   Sample No. 6   Samp			·									
Sample No. 4.   Sample No. 5   Sample No. 6   Sample No. 6     No. of Visible Wires Broken   Cyoles   No. of Visible Wires Broken   N												
Sample No. 4   Sample No. 5   Sample No. 6   Sample No. 6     No. of Visible Wires Broken   Gycles   No. of Visible Wires Broken   No												
Sample No. 4.   Sample No. 5   Sample No. 6   Sam												
Sample No. 44   Sample No. 5   Sample No. 5   Sample No. 6   Sam												
No. of Visible Wires Broken         Cycles         No. of Visible Wires Broken         Cycles         No. of Visible Wires Broken		Samp1				Sample				Sample	1	
ed Pulley E         Pulley E         Completed         Pulley E         Pulley F         Pulley G         Completed         Pulley F	Cycles		sible Wire.	s Broken	Cycles	of	sible Wire		Cycles	şo	sible Wires.	a Broken
13         6         8         15,000         5         8         7         15,000         7         1           21         8         20         19,000         11         12         10         15,000         7         1           21         8         20         19,000         11         12         10         1         1           22         19,000         11         12         10         10         1	completed		Pulley F		completed			Pulley G	completed		Pulley F	Pulley G
13         6         8         15,000         5         8         7         15,000         7           21         8         20         19,000         11         12         10         8         7           12         13         12         10	10,000	4	3	1	10,000	2	2	1	10,000	4	3	p-4
21 8 20 19,000 11 12 10	15,000	13	9	8	15,000	5	8	7	15,000	7	17	9
	18,000	27	8	20	19,000	11	12	10				
			,									
												-
							,					

:	න න			10	T	Π	T		<u> </u>	Ī	Τ	T			<sub>O</sub>	Γ						1	7
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	25. Inch		s ėroken	Pulley	2	91								s Broken	Pulley.	7	2						
ov	Pulley Diameter 2.25.Inches	No. 3	Visible Wires	Pulley F	3	13							No. 6	of Visible Wires	Pulley F	7	16						
Test fype	Pulley D	Sample	No. of Vi	Pulley B	1	4							Sample	No. of Vi	Pulley E	0	Ţ						
	1.50 Inches		Cvcles	completed	10,000	16,000								Cycles	completed	10,000	16,000						
	Stroke - 1:		s Broken	Pulley G	2	3								s Broken	Pulley G	0	5						
ilures	3601b. Str	No. 2	Visible Wires	Pulley F	8	14							No. 5	of Visible Wires	Pulley F	6	18						
isible Wire Failures		Sample	No. of Vi	Pulley E	3	4							Sample No.	No. of Vi	Pulley E	4	7						
>	Rope Tension		Cycles	completed	11,000	16,000								Cycles	completed	11,000	16,000						
Progression of	cles/Win.		s Broken	Pulley G	3	5	8							s Broken	Puiley G	5	12	21					
	50 Cycles/Win.	Le No. 1	of Visible Wires	Pulley F	¥	9	14				7.		Sample No. 4	of Visible Wires Broken	Pulley F	p=1	8	14					
		Sample	No. of Vi	Pulley E	5	9	14						Sampi	No. of Vi	Pulley E	p-1	- 1	11					
	Cycling Speed		Cycles	completed	11,000	15,000	20,000							Cycles	completed	11,000	15,000	20,000					
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			Progression of V	on of Visib	isible Wire Failures	llures			Test Type	10	* * * * * * * * * * * * * * * * * * *
Cycling Speed		100 Cycles/Win.	les/Min.	Rope Tension	on1401b.		Stroke 1.	1.67Inches	Pulley Diameter		2.50 Inches
	Sample No.	9 No. 1			Sample	No. 2			Sample N	No. 3	
	No. of Visible	sible Wires	s Broken	Cvcles	No. of Vi	Visible Wires	Broken	Cvcles	No. of Vi	Visible Wires	3 Broken
Cycles completed	Pulley F	Fulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
30.000	0	3	-	40,000	0	4	1	000 07	2	-	1
75,000	×	7	7	65,000	0	7	+	65,000	3	2	7-
58,000	2	7	9	80,000	1	10	1	84,000	7	4	· <del>†</del>
80-000	3	5	2	90,000	2	40	1	105,000	4	5	4.
100 000	2	7	6	100,000	3	10	2	125,000	5	7	7
113 000	, ,	6	10	11.8,000	3	11	3	145,000	5	7	11
125,000	2	6	13	173,000	4	12	4	160,000	8	7	12
2007-21		,,,									
	Sampl	Sample No. 4			Sample	No. 5			Samile	No. 6	
66	No. of Vi	of Visible Wires	s Broken	Cvcles	No. of Vi	of Visible Wires	s Broken	Cycles	No. of Vi	of Visible Wires	s Broken
completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
30,000	0	1	0	000 01	4-	4	2	000°0†	1	2	±
45.000	2	2	1	65,000	5	80	3	65,000	2	2	æ,
58.000	2	2	1	80,000	7	11	5	80,000	2	77	œ.
80,000	^	2	7	000*06	7	12	5	95,000	2	-2	7
40C 00C	0	Q.	5	100,000	8	13	7	115,000	3	77	£0
113 000	0	5	7					135,000	6	4	69
200	,	41.	40					150,500	10	5	يه
1629000	-		2					170,000	12	7	6
		-					<u></u>				

Test Tune 11		1	No. of Visible Wires Broken	THE AG		0	0	3	5 4	6 5	9 9	9 10	16	Sample Nc. 6		d Pullev E Pullev F	0 0	0	0 0	0 3	19 3 1				TABLE 12
	1.67.Inches	-	ken	10	1		7	7				7	106.302		en	U	-	10,370	15,720	24,2070	56,567	-		-	
	Stroke -		Wires Broken	Pulley	0	0	7	10	13						es Broken	Pulley	0	-	-	-					
ilures	140 lb. St	No. 2	Visible Wir	Pulley F	3	3	9	9	7					No. 5	Visible Wires	Pulley F	-	4	9	8					
le Wire Fa	1	Sample	No. of Vi	Pulley E	3	3	7	9	8					Sample No.	No. of Vi	Pulley E	-	4	11	12					
Prograssion of Visible Wire Railures	Rope Tension		Cycles	completed	27,784	30,447	41.510	52,518	62,014						Cvcles	completed	15,816	28,406	38,208	45,314			l of test.	+	
Prograss	Cycles/Kin.		s Broken	Pulley G	3	26									s Broken	Pulley G	-	9					broken at end		
	25 Cy	.e No. 1	of Visible Wires	Pulley F	5	14								e No. 4	Visible Wires	Pulley F	4	7					3 wires b		
		Sample	No.	Pulley B	0	6								Sample No.	No. of Vis	Pulley E	5	23					Pulley D.	7	
7.15	Cycling Speed	60	Cycles	completed	31,320	64,032									Cycles	completed	31,320	64,031					SAMPLE 4		

TABLE 12 (Conth)

(೧೦ಬ್ಬಿಡ್ನಿ)		250 Inches		3mken		s Karrey			-				Broken	בי יסורוים	•						-
TABLE 12	11			ble Wires	ß	4	+		+	+			Wires	Pulley R P	+	+	-	-			
	Test Type .11	Pulley Diameter	Sample No.	No. of Visible	E	;		-				 Sample No.	No. of Visible	Pullev E Pu	1-					-	
		.1567. Irches		-	Cycles completed 1		-						N selon	<u></u>							
		+1		Wires Broken	Pulley G								Broken	Pulley G							
	ilures	140lb. Stroke	No.	of Visible Wire	Pulley F							No.	Visible Wires	Pulley F							
	ole Wire Failures		Sample	No. of Vi	Pulley E							Sample No.	No. of Vi	Pulley E							
-	on of Visible	Rope Tension		Cvcles	completed								Cycles	comple ted						of test.	
	Frogression	cles/Win.		s Broken	Pulley G	17							Broken	Pulley G	18				-	oken at end	•
		25 Cycles/Win.	Le No. 7	of Visible Wires	Pulley F	20						e No.8	of Visible Wires	Pulley F	15					3 wires broken	-
		Speed &	Sample	No. of Vi	Pulley E	19						Sample	No.	Fulley E	15					rulley D.	-
		E Cycling Speed		Cycles	۰	86,913							Cycles	completed	86,913					SMITTE 0.	

			Progressi	Progression of Visible Wire Failures	de Wire Fa	ilures			Test Type	e 12.	
Cyclin	Cycling Speed59	79 Cy	Cycles/Win.	Rope Tension		1401b. Stroke	÷1	. 1.67 Inches	Pulley Diameter		2.50.Inches
	Sample	le No. 1			Sample	. No. 2			Sample	No. 3	
Gvcles	No. of	Visible Wires	e Broken	Cycles	No. of Vi	Visible Wires	s Broken	Cvcles	No. of Vi	Visible Wires	s Broken
completed	ted Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
40,130	0 2	2	0	62,402	8	13	3	19,834	0	2	O
92,610	9 0	7	7	78,308	10	15	5	37,307	•	5	-
111,973	3 11	9	6	98,880	13	16	8	53,350	-	7	7
130,000	0 13	12	17	111,127	15	18	10	73,250	3	10	6
14,7,077	7   16	15	16					91,100	6	10	12
162,854	4 19	19	17								
	Samp.	Sample No. 4			Sample No.	. No. 5			Sample	No. 6	
Cycles	No.	of Visible Wires	s Broken	Cycles	No. of Vi	of Visible Wires	s Broken	Cycles	No. of Vi	of Visible Wires	s Broken
completed	ted Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
40,130	0 0	Ø	3	62,402	1	9	4	18,834	τ-	0	0
92,610	<b>7</b> 0	7	8	78,308	5	8	9	57,307	3	1	77
111,973	3 5	8	11	98,880	6	12	10	53,350	8	9	9
130,000	0 7	6	13	111,127	15	16	13	73,250	10	13	9
147,077	7 11	10	15					91.100	12	12	11
162,854	4 14	11	16								
ART											
	-										
											2
										E	TATE 12

TABLE 13 (Contd.)

			Des	۲	72 22	£ 3					
			riograssion or	-	istore wire remures	semit			Test Typ	Test Type 12 Continued	med
Cycling Speed		50 Cycles/Win.	cles/Win.	Rope Tension	on146lb.	lb. Str	Stroke1.5		Pulley Diameter	iameter 鵅	2.5% Inches
	Sample No.	e No. 7			Sample	No.			Sample	No.	
Cycles	No. of Vi	of Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken	Cvcles	No. of Vi	Visible Wires	s Broken
completed	Pulley E	Pulley F	Pulley G	sompleted	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
17,050	0	-	C								
30,085	1	2	0								
43,780	2	2	0								
63,340	9	4	0								
84,780	11	7	5								
99,872	16	5	9								
	Sample No.	e No. 8			Sample No.	No.			Sample No.	No.	
Cycles	No.	of Visible Wires	s Broken	Cycles	No. of Vi.	Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken
completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley (
17,050	1	0	0								
30,085	2	,	2								
43,780	3	1	2								
63,340	4	3	4								
84, 780	10	8	8								
99,872	16	14	15								
	Anna										

	, s	Γ	ı.	C	T	T	Τ	Ī	T	T	T	T	T		T <sub>c</sub>	ڻ	Γ	T	Ţ-	T	T	Ţ	Ţ	Π	٦	
	56.Inch		s Broken	Pulley	2	9	9								s Broken	Pulley	7	9	8							TABLE 14
13	ameter 2	No. 3	Visible Wires	Pulley F	3	6	13							No. 5	of Visible Wires	Pulley F	5	14	17							E+
Test Type	Pulley D	Sample No.	No. of Vi	Pulley E	+	2	3							Sample 1	No. of Vi	Pulley E	4	α	12							
	1867Inches		ماريين	completed	30,018	46,032	61,052								Cvcles	completed	30,018	46,032	61,051							
	+1		g Broken	Pulley G	0	-	5								s Broken	Pulley G	2	8	21							
ilures	240lb. Stroke	No. 2	of Visible Wires	Pulley F	4	8	12							No. 5	sible Wires	Pulley F	3	4	2							
isible Wire Failures		Sample	No. of Vi	Pulley E	9	9	11							Sample No.	No. of Visible	Pulley E	Û	4	9							
on of Visib	Rope Tension		Cycles	completed	40,015	690,09	81,017								Cycles	completed	40,045	290.09	81,014							
Progression of V	Cycles/Win.		3 Broken	Pulley G	0	2	4	4	8	12	14				Proken	Pulley G	G	2	4	5	9	8	11			
	199 Cyc	e No. 1	of Visible Wires	Pulley F	3	3	4	7	10	15	17			e No. 4	sible Wires	Pulley F	3	4	5	9	7	1,1	12			
		Sample	No.	Pulley E	2	2	3	3	4	10	14			Sample No.	No. of Visible	Pulley E	0	0	Ó	3	3	9	6			
	Cycling Speed		Cycles	completed	15,081	20,020	30,227	45,069	61,026	76,203	81,180				Cycles	completed	15,086	20,025	30,231	45,071	61,028	76,205	81,181			
TAT	s/20/	20																					RLE			

			Progression of	1 P	isible Wire Failures	ilures			Test Type	e14.	
Cycling Speed	Speed 2	25 Cyc	Cycles/Min.	Rope Tension	on 2401b.	lb. Str	Stroke 106	. 1.67 Inches	Pulley D.	Pulley Diameter 2,59. Inches	50.Inches
	Sample	e No. 1			Sample	No. 2			Sample	No. 3	
Cycles	No. of Visible	sible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken	Cvcles	No. of Vi	Visible Wires	s Broken
completed	1 Pul sy E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
25,000	11	9	7	22,000	3	9	5	10,000	1	0	<b>7</b> ~
31,000	17	12	9	28,000	9	13	9	15,000	7	1	٤
33,000	ઝ	15	7					20,000	4	3	3
								26,000	7	6	8
								30,000	14	71	10
	Sample No.	e No. 4			Sample	No. 5			Sample 1	No. 6	
Cycles	No. of Vi	of Visible Wires Broken	s Broken	Cycles	No. of Vi	Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken
completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Fulley F	Pulley G	completed	Pulley E	Pulley F	Pulley 3
25,000	2	7	5	22,000	9	4	10	15,000	0	0	4
31,000	3	10	7	28,000	9	7	17	20,000	1	0	3
33,000	3	15	8					25,000	2	Ċ	5
								30,∾0	3	2	8
								35,000	7	3	6
								000,04	11	9	10
								000,94	14.	12	16
SAMPLE 6	Fulley D	1 wire broken at	coken at end	d of tests							

Test Type	Dismeter 2.50 Inches	: No. 3	of Visible Wires Broken	Pulley F   Pulley G	1 6	2 3	3 3	4 3	7 5			. No. 6	Visible Wires Broken	Pilley F Pulley G	1 1	1 6	2 18						TABLE 16
Test Ty	Pulley	Sample	No. of V	Pulley E	O	2	9	8	13			Sample No.	No. of V	Pulley E	0	0	-						
	1.67Inches		Cvcles	completed	15,039	20,002	25,003	30,008	35,004				Cvcles	completed	15,091	21,055	26,060						
	Stroke + .1.6		s Broken	Pulley G	0	1	2	3					s Broken	Pulley G	*-	2	2	2	5	8	12		
ilures		No. 2	of Visible Wires	Pulley F	2	3	4	9				No. 5	Visible Wires	Pulley F	0	2	Þ	L	7	10	12		
fisible Wire Failures	on240lb.	Sample	No. of Vi	Pulley E	3	7	10	16				Sample No.	No. of Vi	Pulley E	0	3	4	5	7	8	8		
>	Rope Tension		Cycles	completed	15,033	21,004	25,004	31,004					Cycles	completed	15,004	20,006	25,003	32,195	35,125	40,000	45,325		
Progression of	cles/Min.		s Broken	Pulley G	2	5	5	5	7	8			s Broken	Pulley G	0	8	14						
	Gycles/Win.	e No. 1	of Visible Wires Broken	Pulley F	0	0	9	10	٥ŀ	13		e No. 4	of Visible Wires	Pulley F	0	3	9						
		Sample	No. of Vis	Pulley E	1	2	5	7	10	11		Sample No.	No. of Vi	Pulley E	2	*	5						
	Cycling Speed		Cvcles	completed	15,150	20,315	25,030	30,004	35,023	40,014			Cvcles	completed	15,150	20,315	25,030						

			Dry congestion of		Wiethle Wim Beile	£ 7.					
		9			84 944 94	ee mrt			Test Type	٥	^ ÷ • • • • • • • • • • • • • • • • • •
ing S	Cycling Speed Cycles/Min.	Cy.	cles/Win.	Rope Tension	1	360lb. Stroke -	oke ± .1.6	1.67 .Inches	Pulley Diameter		2.50 Inches
	Sample Nc.	e Nc. 1			Sample	110. 2			Sample No.	No. 3	
Cycles	No. of Vi.	of Visible Wires	s Broken	Cycles	No. of Vi	of Visible Wires	s Broken	80[04]	No, of Vi	Visible Wires	s Broken
completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
10,000	O	7	0	10,000	3		0	10,000	5	-	*
15,000	1	4	3	15,000	ŗ	5	2	15,000	6		9
20,000	4	7	4	21,000	1	9	4	20,000	11	2	5
25,000	4	10	9	26,000	2	8	5	25,000	14	5	55
30,000	5	10	11	31,000	5	6	Θ				
35,000	8	15	16	37.000	3	1.1	13				
	Sample No.	e No. 4			Sample No.	. No. 5			Sample	No. 6	
Cycles	No.	of Visible Wires Broken	s Broken	Cycles	No. of Vi	sible Wires	s Broken	Cycles	No. of Vi	Visibie Wires	s Broken
completed	Fulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
10,000	5	0	3	10,000	1	2	2	10,000	-	0	c
15,000	14	-	Ł	15,000	2	5	2	15,000	2	1	~
20,000	18	3	11	21,000	7	8	9	20°000	2	2	3
				26,000	အ	15	6	25,000	9	6	æ
				31,000	11	21	12	30,000	9	11	1:1
								35,000	В	14	1,5

			Progressi	Progression of Visible Wire Failures	le Wire Fa	ilures			Theat Thoma		
Cycling Speed		25 Gycles/Min.	cles/Min.	Rcpe Tension		360lb. Stroke	+1	1.67	Fulley Diameter		2.50 Trches
	Sampl	Sample No. 1			Sample	No. 2			Sample	No. 3	
Cycles	No. of Vi	Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken	Creles	No. of Vi	Visible Wires	s Broken
completed	Pulley B	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
10,000	5	q.	ا ا	10,000	3	3	0	10,000	4-	0	0
15,000	9	8	4	15,000	L	8	0	15,000	9	3	3
18,000	16	12	11	20,000	12	10	4	20,000	6	10	7
								25,000	13	16	12
	_ <del>_</del>										
	Sampl	Sample No. 4			Sample	No. 5			Sample	No. 6	
Cycles	No.	of Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken	Cvcles	No. of Vi	Visible Fires	s Broken
completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
10,000	0	23	O	10,000	1	9	5	10,000	2	2	5
15,000	-	11	3	15,000	8	10	14	15,000	7	5	13
18,000	5	17	9								

	2.5QInches			es Broken	Pulley G			ĵ											Pulley G	2	9	7	-					
		M.C. 2	130		Pulley F	100	1	:							The same of the sa	No. 6	Sible Wire		Pulley F	8	11	13					1	
	Pulley	- Lumay	Prompo	Nc. of V	Pulley E	0	0									Sample	No. of Vi			0	3	3						
	67. Inches			Cycles	completed	10,000	14,000											completed		10,000	15,000	18,000					1	
-	+1			es Broken	Pulley G	m	4	9	8	11	13						s Broken			0	-	3	9	9				
		e No. 2		isible Wir		2	4	4	4	5	8					No. 5		•		7	9	6	11	12				
	£	Sampl		· ·	Pulley	9	9	7	8	6	10					Sample	No. of Vi				4	-	S	8				
!	•			Cycles	,	10,000	12,000	14,000	16,000	18,000	20,000						Cycles	completed	10.000	000	200467	17,000	20,000	22,000				
- 511/ 00 [01	cres/min.		s Broken	11		0	2										3 Broken	Pulley G	2	8		14						
Q	3				T Carrie	٥	12									# to 100	sible Wires	Pulley F	4	8	1	2			1			
Speed5		Namp	No. of V		2	,	•								Samp		ွ		0	2	1							
	<u> </u>		200	complete	10,000	15,000									•		Cycles	noo o tollino.	10,000	15,000	20,000							
	Cycling Speed 50 Test Type	Cycling Speed 50 Cycles/Min. Rope Tension 360 1b. Stroke 167 Inches Pulley Diameter	Cycling Speed 50 Cycles/Min. Rope Tension 360 lb. Stroke + .1.67 Inches Pulley Diameter Sample No. 1 Sample No. 2	Rope Tension3601b. Stroke1.67Inches Pulley Diameter Sample No. 2 Sample No. 3	Cycling Speed50 Cycles/Min. Rope Tension3601b. Stroke167Inches Pulley Diameter  Sample No. 1  Cycles  No. of Visible Wires Broken  Cycles  Cycle	Cycling Speed50 Cycles/Min. Rope Tension3601b. Stroke that the following Speed50 Cycles Sample No. 7  Cycles No. of Visible Wires Broken Cycles Completed Pulley E Pulley	Cycling Speed 50 Cycles/Min.         Rope Tension 360 lb Stroke1 67 lnches Pulley Diameter           Sample No. 1         Sample No. 1         Sample No. 5         Test Type 1.1 67 lnches Pulley Diameter           Cycles         No. of Visible Wires Broken           10,000         6         6         2         3         10,000         0         10,000	Cycling Speed 50 Cycles/Min.         Rope Tension 360 lb. Stroke ± 467 lnohes Pulley	Cycling Speed50 Cycles/Min.         Rope Tension360lb. Stroke ±1467Inohes         Fulley Tape           Sample No. 1         Sample No. 1         Sample No. 2         Sample No. 3         Tape	Cycling Speed 50 Cycles/Min.         Rope Tension 360lb. Stroke ± 1.67 Inches         Follow Pulley Pu	Cycling Speed 50 Cycles/Min.         Rope Tension 360 lb. Stroke ± 467 Inches         Pulley Diameter           Sample No. 1         Sample No. 1         Sample No. 2         Sample No. 2         Sample No. 3         Pulley Diameter           Cycles         No. of Visible Wires Broken         Cycles         No. of Visible Wires Broken         Cycles         No. of Visible Wires Broken         Oycles         No. of Visible Wires Broken         No. of Visible Wires Broken         No. of Visible Wires Broken         Oycles         No. of Visible Wires         No. of Visible Wi	Cycling Speed50   Cycles   Rope Tension360   Sample No. 7   Sample No. 7   Sample No. 6   Sample No. 6   Sample No. 7   Sample No. 7	The continuous conti	Cycling Speed54 Cycles/Win.   Rope Tension360lb. Stroke1.67Inohes   Pulley Diameter	Cycling Speed50   Cycles   Mo. of Visible Wires Broken   Cycles   Mo. of Visible Wiley   Mo. of Visible Wiley   Mo. of Visible Wiley   Mo. of Visible Wiley   Mo. of Visible Wires Broken   Cycles   Mo. of Visible Wiley   Mo. of	Cycling Speed	Cycling Speed50 Cycles/Min. Rope Tension3601b, Stroke ±167Inches         Test Type	Cycling Speed52   Cycles   Miles   Pulley   Pu	Cycling Speed Strong Sample No. 1   Sample No. 1	Cycling Speed 50         Cycling Speed 50         Cycles Sample No. 1         Sample No. 5         Sample No. 6         Sample No. 6         Sample No. 6         Sample No. 6         A 14,000         O 10,000         O 10,000         O 10         O 14         O 10         O 10 <t< td=""><td>  Cycling Speed 59 Cycles   No. of Visible Wires Broken   Cycles   Sample No. 5   Sample No. 6   Sample</td><td>  Cycles   No. of Yisible Wires Broken   Cycles   No. of Visible Wires Broken   Cycles   Pulley E   /td><td>  Cycling Speed St   Cycles   Sample No. 1   Sample No. 2   Sample No. 5   Sample No. 6   Sample No. 5   Sample No. 6   Sample No. 6   Sample No. 6   Sample No. 5   Sample No. 6   Sample No. 6</td><td>  Cycling Speed St   Cyclas/Min.   Rope Tension 360   Sample No. 2   Sample No. 5   Sample No. 6   Sample No. 6</td><td>  Cycling Speed5Q   Cycles   Sample No. 1   Sample No. 2   Sample No. 5   Sample No. 6   Sample No. 6</td><td>  Cycling Speed5Q</td><td>  Cycling Speed5Q Cycles/Min. Rope Tension36Qlb. Stroke #14GIndees Pulley Displayed Pulley B Pu</td><td>Cycling Speed3030</td></t<>	Cycling Speed 59 Cycles   No. of Visible Wires Broken   Cycles   Sample No. 5   Sample No. 6   Sample	Cycles   No. of Yisible Wires Broken   Cycles   No. of Visible Wires Broken   Cycles   Pulley E   Pulley E	Cycling Speed St   Cycles   Sample No. 1   Sample No. 2   Sample No. 5   Sample No. 6   Sample No. 5   Sample No. 6   Sample No. 6   Sample No. 6   Sample No. 5   Sample No. 6   Sample No. 6	Cycling Speed St   Cyclas/Min.   Rope Tension 360   Sample No. 2   Sample No. 5   Sample No. 6   Sample No. 6	Cycling Speed5Q   Cycles   Sample No. 1   Sample No. 2   Sample No. 5   Sample No. 6   Sample No. 6	Cycling Speed5Q	Cycling Speed5Q Cycles/Min. Rope Tension36Qlb. Stroke #14GIndees Pulley Displayed Pulley B Pu	Cycling Speed3030

			Progression of V	ion of Visit	isible Wire Railures	ilures			Test Tvne	1	19
Cycling S	peed	Cycling Speed Cycles/Win.	rcles/Win.	Rope Tension	ion1401b.	lb. Str	Stroke1	1.83.Inches	Pulley D	ameter	.2.75Inches
	Sampl	Sample No. 1			Sample	. No. 2			Sample	No. 3	
Cycles	No.	of Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken	ດີປດໄລສ	No. of Vi	of Visible Wires	s Broken
completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
100,000	0	0	1	150,000	ļ	0	5	150,000	-	0	1
160,000	0	0	2	260,000	9	٠	11	260,000	1	၁	3
250,000	2	0	3	400,000	15	+-	14	400,000	-	0	9
320,000	9	-	9	427,000	17	1	14	550,000	5	0	10
401,000	7	-	9					601,000	9	C.	13
500.000	17	2	15								
	Sampl	Sample No. 4			Sample No.	No. 5			Sample No.	No. 6	
Cycles	No. of	Visible Wires	s Broken	Cycles	No. of Vi.	of Visible Wires	s Broken	Cvcles	No. of Vi	Visible Wires	s Broken
completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
160,,000	-	0	0	150,000	2	1	0	150,000	O	4	1
251,000	-	0	2	260,000	4		3	260,000	3	9	2
320,000	2	0	4	420,000	6	9	6	000°00V	9	10	8
401,000	9	2	5	427,000	11	9	12	438,000	9	13	10
500,000	16	2	8								
								, man			
										TABLE 20	0

			Progression of	ion of Visible	le Wire Failures	ilures			Test Type		20
Gycling Speed		Cycles/Win.	cles/Min.	Rope Tension	on .1401b.	lb. Stroke	+1	1.83. Inches	Pulley Diameter		.2:75nches
	Sampl	Sample No. 1			Sample	No. 2			Sample	No. 3	
g of Ox?	No. of Vi	of Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Brollen	Cvcles	No. of Ti	risible Wires	s Broken
completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
90,720	3	0	0	82,130	0	4	₹-	63,660	0	0	0
101,070	4	4-	0	90,720	7	4	2	123,030	0	0	0
132,770	7	2	2	101.070	5	4	3	133,324	0	9	7/
166,970	11	4	7	132,770	9	5	3	14,1,174	0	9	4
174.170	12	7	9	166,970	o	8	7	151, 904	O	7	5
184.4.70	13	5	7	174.170	6	8	7	162,900	2	9	5
199,840	15	5	7	184,470	6	6	4	171,800	3	19	9
				199,480	6	11	4				
				210,460	6	12	47				
	Sampl	Sample No. 4			Sample	No. 5			Sample	No. 6	
Cvcles	No. of Vi	of Visible Wires Broken	s Broken	Cvcles	No. of Vi	Visible Wires	s Broken	Cycles	No. of Vi	of Visible Wires	s Broken
completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
40,615	1	0	0	45,200	7	0	ပ	62,120	0	ဂ	0
60,423	3	0	1	52,650	2	0	0	69,530	-	2	3
99,010	4	-	-	62,000	2	0	+	101,365	3	5	5
128,050	5	5	2	71,615	3	O	2	114,196	4	œ	8
138,684	5	5	4	114,740	5	-	7	153,165	7	13	17
177,893	9	7	5	122,230	7	-	7				
190,870	9	8	5	154,014	8	-	12				
215,150	9	10	5								
245,860	10	12	6								

5	E	25	Progression of	> =	isible Wire Failures	1	+1	1.83 Inches	Test Typ	Test Type 20 Centinued Test Type 20 Centinued	tinued 2.75 Tropas
Cycling Speed	<b>\</b>		Cycles/Min.	Rope Tension	- (	No.	.	. Tuches		•	sauour
odmoo	4 l				OT dimon						
No. of	42	of Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken
Pulley	छ	Pulley F	Fulley G	completed	Puliey E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
2		0	3								
3		1	3								
9		4.	7								
7		4	11								
7		В	16								
7		9	19								
7		9	20								
ω		6	27								
ω		13	31								
	Sample	e No. 8			Sample	No.			Sample No.	No.	
No.	of Vi	of Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken	Cycles	No. of V	Visible Wires	s Broken
4	Pulley E	Fulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
0		0	2								
2		3	47								
5		3	4.	Sample	e 2. Pull	ev H. 1 wire	broken	at end of t	est		
3		3	1,	Samp1	e 4. Pull	by H, 1 wi	re broken	at end of t	est		
5		-1	5	Samp	e 6. (Pull	by H, 1 wi	re broken	at end of t	est		
2		8	8		(Pul)	by D, 1 wi.	e broken	t end of t	test		
7		10	6	Sampi	e 7, Pull	ey D, 2 wi	res broken	at end of	test		
18		13	13	Samp	8 8	Pulley D, 1 wi	wire broken	at end of t	test		
											1
1										TABLE 21	1 (Contd.)

	Sanole No.	Sample No.	ON STÄURC		Sample No.	Sample No. 3		* Stroke + .1.83. Inches Pulley Diameter 2.75. Iriches		Test Type
Sample No.  No. of Visible 1	No. of Visible Wires Pulley E Pulley F  1	No. of Visible Wires  Pulley E Pulley F  1	No. of Visible Wires Pulley E Pulley F  1	No. of Visible Wires Pulley E Pulley F  1	No. of Visible Wires Pulley E Pulley F 1	No. of Visible Wires  Pulley E Pulley F  1	Sample No. 3  No. of Visible Wires  Pulley E Pulley F  1	Sample No. 3  No. of Visible Wires  1	Pulley Diameter Sample No. 3  No. of Visible Willey E  2 2 3 4 5 7 7 7 7 10 10 10 11 10 15 No. 6 No. of Visible Willey E Pulley E Pulley 0 3	Sample No. 3  No. of Visible Wiley  1 1 1  2 2 3  4 5 7  10 10  11 10  15 10  15 10  Sample No. 6  No. of Visible Wiley  Pulley E Pulley  Pulley E Pulley  o
Cycles completed 34,270 61,330 80,510 105,350 169,750 190,770 24,5,613 24,9,44,2 312,917	Cycles completes completes 34,270 (4,530 80,510 105,350 190,770 24,5,613 312,917	Cycles completed 34,270 61,530 80,510 105,350 169,750 190,770 24,5,610 24,5,610 312,917	Cycles completed 34,270 61,330 80,510 105,350 169,750 190,770 24,5,613 212,917	Cycles completed 34,270 61,330 80,510 105,350 169,750 190,770 24,5,613 212,917	Cycles completed 34,270 (4,530 80,510 105,350 190,770 245,613 245,412 312,917	Cycles completed 34,270 61,530 80,510 105,350 159,770 245,610 245,610 312,917	Cycles complete 34,270 61,530 80,510 105,350 169,750 190,770 245,613 245,613 245,442	Cycles completed 34,270 (61,130 80,510 105,350 159,770 245,610 245,610 312,917	Cycles complete Cycles complete 34,270 61,530 80,510 105,350 169,750 190,770 245,613 245,613	33Inches Cycles complete 34,270 61,530 80,510 105,350 169,750 190,770 245,613 245,613 245,613 245,613
s Broken Pulley G  1  4  4  4  5  5  6	Broken  1  4  4  4  4  5  5	Broken 1 1 4 4 4 4 5 5 6	Broken hulley 1 1 1 4 4 4 4 5 5 5	Broken hulley 1 1 1 4 4 4 4 5 5 5	Broken  1  4  4  4  4  5  5	Broken 1 1 4 4 4 5 5 6	Broken ulley 1 1 4 4 4 5 5 5	Broken 1 1 1 4 4 4 4 6 5 5 6	Brok 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Brok Brok
No. Sible Pull 2 2 2 2 2 2 4 4 4 4 4 4 4 4 4 4 4 4 4	Pulle 6 6 7 7 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9						No. 3 sible 2 2 2 7 7 7 9 9 9 9 9 9 9 9 9	No. 3 sible 2 2 2 2 4 4 4 6 6 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9		
Sample No. of Vis Pulley E 0 1 1 1 2 2 2 3 5	of 11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	of 1 1 1 1 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3 3	of 1 1 1 0 0 0 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3	of 1 1 1 0 0 0 2 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3	of 1 1 1 0 0 0 2 2 2 2 2 2 2 2 2 2 2 2 2 2	of 1 1 1 1 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3 3	Sami of 1 1 1 1 1 1 2 3 3 5 5 5 5 5 7 7 7 7 7 7 7 7 7 7 7 7 7	Sami of 1116y 3 3 5 5 5		Sami Sami 111ey 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Cycles completed 95,910 115,933 185,150 261,000 264,832 328,321 343,346	Cycles completed 95,910 115,933 185,150 264,832 328,321 343,346	Cycles completed 95,910 115,933 185,150 264,832 328,321 343,346	Cycles completed 95,910 115,933 185,150 264,832 328,321 343,346 391,650	Cycles completed 95,910 115,933 185,150 264,832 328,321 343,346 391,650	Cycles completed 95,910 115,933 185,150 264,832 328,321 343,346	Cycles completed 95,910 115,933 185,150 264,832 228,321 343,346	Cycles completed 95,910 115,933 185,150 264,832 328,321 343,346	Cycles completed 95,910 115,933 185,150 264,832 264,832 328,321 343,346	Rope Tension Cycles Cycles Cycles P95,910 115,933 185,150 264,832 328,321 343,346	Cycles Cycles completed 95,910 115,933 185,150 264,832 228,321 343,346
Broken 2ulley G 4 5 7 7 7 8 8	Broken 4 4 5 5 7 7 7 8 8 8	Broken 2, 4, 5 7, 7 8, 8	Broken 2ulley G 4 5 7 7 7 7 8 8	Broken 2ulley G 4 5 7 7 7 7 8 8	Broken 2 4 4 5 5 7 7 7 8 8 8 8	Broken Aulley G 4 5 7 7 7 8 8	Broken Aulley G 4 5 7 7 7 8 8	Broken 4, 4 5 7 7 7 8	les/Min. Broken 2ulley G 4 5 7 7 7 8 8	les/Min. Broken 4, 4, 5 7, 7, 7, 8, 8
	Pulley F  2 2 2 2 2 5 6 7	Pulley F  2 2 2 2 2 5 5 6 7	Pulley F  2 2 2 2 5 6 7 7	Pulley F  2 2 2 2 5 6 7 7	Pulley F  2 2 2 2 2 5 6 7 7	Pulley F 1 2 2 2 2 5 5 6 7	sible Wires Pulley F  2 2 2 2 2 6 5 6 7	sible Wires Pulley F  2 2 2 2 2 7 7		· -
No. 11 2 2 2 2 8 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9	No. 11 1 10 11 11 11 11 11 11 11 11 11 11 1	No. 5 2 2 8 8 8 8 9 9 9 9 11 11 11 11 11 11 11 11 11 11 1	No. CLUA 2 2 2 2 2 8 8 8 8 11 11 11 11 11 11 11 11 11 11 1	No. CLUA 2 2 2 2 2 8 8 8 8 11 11 11 11 11 11 11 11 11 11 1	No. [110.]	No. 17 2 2 9 9 9 9 11 11 11 11 11 11 11 11 11 11 1	No. 1117 101 101 111	No. 17 2 2 8 8 8 9 9 11 11 11 11 11 11 11 11 11 11 11 11	Sample Sample No. of Vi Pulley E  7  8  8  9  10  11	Sample No. of Vis Pulley E 8 8 8 9 10
Cycles completed 114,829 150,110 180,143 211,042 228,100	Cycles completed 114,829 153,308 150,110 180,143 211,042 228,100	Jycles completed 114,829 153,308 150,110 180,143 211,042 228,100	Cycles completed 114,829 150,110 180,143 2211,042 228,100	Cycles completed 114,829 150,110 180,143 211,042 228,100	Cycles completed 114,829 153,308 150,110 180,143 211,042 228,100	Cycles completed 114,829 153,308 150,110 180,143 211,042 228,100	Cycles completed 114,829 133,308 150,110 180,143 211,042 228,100	Cycles completed 114,829 153,308 150,143 211,042 228,100	Cycling Speed	Cycling Sycles completed 114,829 153,308 150,143 211,042 228,100

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Cycling Speet 25.   Cyclos   Cycl				Program	Bion of Wine	12.3					WII.	FABLE 24	
No. of Visible Wires Broken   Cycles   Cycles   No. of Visible Wires Broken   Cycles   C			ŭ	0	TETA TO HOTE	A SITM STOI	artures			Test Tyn	pe 23		
No. of Yistble Wires Broken   Cycles   Ro. of Yistble Wires Broken   Ro. of Yistble Wires Broken   Cycles   Ro. of Yistble Wires Broken   Ro. of Yistble Wires Broken   Cycles   Ro. of Yistble Wires Broken   Cycl	ing		9	ycles/Min.		•		+1	Inches	Pulley		.75 Inches	
No. of Visible Wires Broken   Cycles   No. of Visible Wires Broken   Occuple ted   Pulley E   Pul	ı	Samp	် ရွှ			Sampl	No.			Sample	i		
15	les	No. of	isible Wir		Cvcles	No.		ss Broken			aible Win	0.00	
15	lete		Pulley	Pulley	completed	Pulley	واريط	Pillon	Cycles completed		THE STORE	s proken	
15   4   5   52,000   4   1   25,000   4   6   2   2   1   6   6   1   1   1   1   2   2   1   1   1   1	000	15	77	,	000			r darray G		rulley E		Pulley 6	
16   6   4   42,000   10   2   3   56,000   4   6   2   1   1   1   1   1   1   1   1   1	000	15	7	, K	20 000	ς.	0	-	25,000	4	2	7-	
16   2   4   442,000   14   3   5   56,000   4   14   14   14   15   14   14   14	8	16			35,000	#		3	36,000	4	9	2	
16   8   8   64,000   14   4   8   65,000   17   14   5     16   10   7   6,000   14   7   13     17   13   14   5   13     18   17,000   14   7   13     18   18   14   7   13     19   1   1   1   1   1     19   1   1   1   2   1     10   1   1   1   2   1     10   1   1   1   2   1     10   1   1   1   2   2     10   1   1   1   2   2     10   1   1   1   2   2     10   1   1   1   2     10   1   1   1   2     10   1   1   1   2     10   1   1   1   2     10   1   1   1   2     10   1   1   1   2     10   1   1   1   2     10   1   1   1   2     10   1   1   1   2     10   1   1   1   2     10   1   1   1   2     10   1   1   1   2     10   1   1   1   2     10   1   1   1   2     10   1   1   1   2     10   1   1   1   2     10   1   1   1   2     10   1   2   3     10   1   2   3     10   1   2   3     10   1   2   3     10   1   3   3     10   1   3   3     10   1   3   3     10   1   3   3     10   1   3   3     10   1   3   3     10   1   3   3     10   1   3   3     10   1   3   3     10   1   3   3     10   1   3   3     10   1   3   3     10   1   3   3     10   3   3     1	8		,	4	42,000	10	2	3	45,000	7	10	-	
Sample No. 4   Sample No. 5   13   66,000   17   14   6   6   6   6   6   6   6   6   6	3 8	16	7	5	53,000	1 1 1 1	2	ۍ	26.000	α			
Sample No. 4   76,000   14   7   13	3	2	8	8	000 49	47	4	8	000*99	17	177	7 7	
Sample No. 4.   Sample No. 5   Sample No. 6   Sam		1		-4	76,000	14	5	13			÷		
Sample No. f         Sample No. f <th colspan<="" td=""><td></td><td></td><td></td><td></td><td>87,000</td><td>14</td><td>2</td><td>13</td><td></td><td></td><td></td><td></td></th>	<td></td> <td></td> <td></td> <td></td> <td>87,000</td> <td>14</td> <td>2</td> <td>13</td> <td></td> <td></td> <td></td> <td></td>					87,000	14	2	13				
Sample No. 5         Sample No. 5         Sample No. 6         Cycles         No. of Visible Wires Broken         Cycles         Cycles         No. of Visible Wires Broken         Cycles         Pulley F         Pulley F         Pulley F         Pulley F         Pulley F         Pulley F         Pulley B         T<		_											
No. of Visible Wires Broken         Cycles         No. of Visible Wires Broken         Cycles         No. of Visible Wires Broken         Cycles         No. of Visible Wires Broken           4 Pulley E         Pulley E         Pulley E         Pulley B													
No. of Visible Wires Broken         Cycles         No. of Visible Wires Broken         Cycles         No. of Visible Wires Broken         Cycles         No. of Visible Wires Broken           2         2         4         42,000         3         4         0         25,000         1         0         0           3         5         53,000         5         5         5         1         36,000         3         1         0         0           4         5         7         76,000         7         10         2         56,000         3         1         0         0           5         10         7         87,000         8         16         2         56,000         9         6         2           7         12         8         8         16         2         56,000         15         7         3           Puiley D, 1 Wire broken at end of test.         8         16         2         66,000         15         7         3		Sampl				Sample	1						
Pulley E   Pulley F   Pulley E    ç		sible Wire	8 Broken		I	1			oambre :	•			
Latiley E         Pulley F         Pulley G         Completed         Pulley F	leted Jeted				Cycles		sible Wire	s Broken	Cycles	of		s Broken	
2         2         4         42,000         3         4         0         25,000         1         0 <th< td=""><td></td><td>Fulley</td><td>Pulley F</td><td></td><td>renerdmos</td><td></td><td></td><td></td><td>completed</td><td>Pulley E</td><td></td><td>z</td></th<>		Fulley	Pulley F		renerdmos				completed	Pulley E		z	
5         3         5         55,000         5         1         36,000         3         1           3         5         6         64,000         6         6         1         45,000         6         3           4         5         7         76,000         7         10         2         56,000         9         6           7         12         8         3         16         2         66,000         15         7           Puiley D, 1 wire breat at end of test.         4         6         6         6         7         6         7	3 3	7	2	4	42,000	3	7	0	25,000	-	0	2	
2         5         6         64,000         6         6         6         1         45,000         6         3           4         5         7         76,000         7         10         2         56,000         9         6           7         12         8         16         2         66,000         15         7           Puiley D, 1 wire broken at end of test.         Atiley D, 1 wire broken at end of test.         6         6         6         6         6         7		1	2	5	53,000	5	5	-	36,000	3	-	C	
4         5         7         76,000         7         10         2         56,000         9         6           5         10         7         8         16         2         66,000         15         7           7         12         8         16         2         66,000         15         7           Pairley D, 1 wire broken at end of test.		7	2	9	64,000	9	9	1	45.000	9			
5         10         7         87,000         8         16         2         66,000         15         7           7         12         8         16         2         66,000         15         7           Puiley D, 1 wire broken at end of test.	3   3	4	5	7	000*92	7	10	2	56.000	, 0	7	- (	
Puiley D, 1 wire broken at end of test.	3	5	10	7	000*48	8	16	6	66,000		0 !	7	
Puiley D, 1 wire broken at end of	8	7	12	8					200	2		2	
Puiley D, 1 wire broken at end of													
	4.	Puiley D,	1 wire	at	9								
								†-	1				

	Inches		Broken	Pulley G	,=	4,	3	1.1						Broken	Pulley G	0	1	7	7	10				
Z	. 2.75		Wires B	FH	-									Wires B	দে					`				LB 25
	Diameter 2:75.Inches	No. 3	Visible W	Pulley	-	5	6	12					No. 6	Visible W	Pulley	0	4	3	9	8				TABLE
Test Type	Fulley D	Sample	No. of Wi	Pulley E	1	3	9	8					Semple No.	No. of Vi	Pulley E	1	3	ħ	8	13				
	.1883Inches		Cvcles	.nmpleted	35,000	55,000	70,000	85,000						Cycles	completed	35,000	55,000	20,000	85,000	101,000				
	+1		3 Broken	Pulley G	1	3	9	9						s Broken	Pulley G	1	7	5	5					
llures	lb. Stroke	No. 2	sible Wires	Pulley F	0	2	3	5					No. 5	Visible Wires	Pulley F	0	0	2	2					
le Wire Fa	on240lb.	Sample	No. of Visible	Pulley E	4	6	6	12					Sample	No. of Vi	Pulley E	1	6	12	474				<del></del>	
Progression of Visible Wire Failures	Rope Tension		Cycles	completed	35,000	50,000	000,09	000 02						Cycles	completed	35,000	50,000	000.09	000*02			s of test.		
Progressi	les/Min.		Broken	Pulley G	-	2	2	2	5	10	15			Broken	Pulley G	1	2	9	12	18	18	broken at end		
	50 Cycles/Win.	No. 1	of Visible Wires	Pulley F	-	1	1	3	9	10	12		No. 4	sible Wires	Pulley F	0	2	2	4	5	7	2 wires b		
		Sample	No. of Vis	Pulley E	-	1	2	3	5	8	6		Sample No.	No. of Visible	Pulley E	1	2	3	8	6	11	Pulley D,		-
	Cycling Speed		Cvoles	completed	25,000	35,000	50,000	65,000	80,000	95,000	110,000			Cvcles	completed	35,000	50,000	65,000	80,000	95,000	110,000	Sample 3.		

The second secon

		<u>u</u>	, 1		Γ	7	,		<del>-</del>	<u>-</u> -T			γ-	<del></del>	 	Γ	<del></del>	<del></del> -		·····	<del></del>	<del></del>			-	-				
56		2.75 Inches			es Broken	Pulley		-   '	,	7	8	6		#					s broken	Pullev G	•	4,5		12						
TABLE	pe . 25	me ter		No. 5	Visible Wires	Pulley F		, ,	7	,	10	11	16				No. 6	)   2	Sallw arcto	Fulley F	4	1 0 0	2	16		,				
	Test Type	Pulley 1		оашрте	No. of Vi	Pulley E	-	7.	+	0	/	6	10				Sample	No. of VI.	3	Pulley E	0	~	1	a	+					
		1.83 Inches			Cycles	completed	20,000	26,000	22 000	200	40,000	1+3,000	000.64		1			-		completed	20,000	26.000	2 000	22000						
		+1			3 Broken	Pulley G	2	2	۶	, ,	+	<del>,</del>	12				•	Broken	T	Pulley G	2	7		+	7.5	13	16			
	Tures	lb. Stroke	No. 2		sible Wires	Pulley F	2	3	7	Ľ	1	07	13		+		No. 5	Visible Wires	f	Pulley F F	-	3	7	-	+	+	6			
		on 360 lb.	Sample		No. of Visible	Pulley E	3	4	7	17	1	0,	9		+		Sample	No. of Vis	r	Pulley E	0	2	5	9	0		13			
312.00	3	Rope Tension			Cycles	Den etd men	18,000	24,000	51,000	37,000	000 77	200	49,000					Cvcles	<u>_</u>	-	16,000	27,000	31,000	37,000	44,000	0000	47,000		_	
Progression	1	les/Min.		Runkon	or ower	Fulley G	-	<b>‡</b>	B							+		Broken	,	ey G	1	1	15 3	-	4		*			
	100	Cy.	e No. 1	of Visible Wires	D. 1.1	rulley F	0	-	8				1				No. 4	of Visible Wires	ק אסרוים		٥١٥	۵	11							
	100	peed	Sample	No. of Vi	7			0	12								Sample No.	No. of Vis	Pulley E	7	7 2	+	+							
					completed	20.000	26,000	20 600	000,20										compreted	20 000	26,000	32 000	2007							-
T	ABLE	26	_												 1									_1_			L	_	1_	J

	•Inches		Bryken	Pulley G	3	9					Broken	Pulley G	7	6				2.1
26	Pullay Diameter 2.75. Inches	. 3	Wires	Pulley F P	2	8				9.	Wires	Pulley F P	12	15				TABLE
Test Type	Pulley Dia	Sample No.	No. of Visible	Pulley B P	5	15				Sample No.	No. of Visible	Pulley E F	3	15				
	1.83 Inches		Cvcles	L	23,000	30,000					Cycles	٣	23,000	30,000				
	+1		Broken	Pulley G	4	9					Broken	Pulley G	9	10				
lures	lb. Stroke	No. 2	of Visible Wires	Pulley F	9	13				No. 5	of Visible Wires	Pulley F	4	7				
le Wire Fai	on360lb.	Sample	No. of Vis	Pulley E	-	3				Sample No.	No. of Vis	Pulley E	14	15				
Progression of Visible Wire Failures	Rope Tension		Cycles	complete	25,000	30,000					Cycles	completed	25,000	30,000				
Progressi	cles/Min.		Broken	Pulley G	5	15					Broken	Pulley G	7	16				
		No. 1	of Visible Wires	Pulley F	3	8				9 No. 4	sible Wires	Pulley F	3	10				
		Sample No.	No. of Vis	Pulley E	47	85				Sample No.	No. of Visible	Pulley E	5	12				
	Cycling Speed		Cycles	completed	25,000	35,000					Cycles	completed	25,000	35,000				

			Progression of V	on of Visible	le Wire Failures	ilures			Test Type	e 27	
Cycling Speed		50 Cycles/Min.	cles/Min.	Rope Tension	360	lb. Stroke	<b>+</b> 1	1.83Inches	Pulley I	Diameter	2.75 Inches
	Sampl	Sample No. 1			Sample	No. 2			Sample	No. 3	
Cycles	No. of Vi	of Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken	Selovi	No. of Vi	Visible Wires	s Broken
completed	Pulley E	Pulley F	Pulley G	completed.	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
26,000	9	0	5	25,000	4	-	8	20,000	7	0	1
31,000	6	3	9	31,000	7	3	13	25,000	5	-	9
50,000	15	5	18	35,000	7	9	15	30,000	9	0	10
								35,000	6	2	13
								000 07	6	9	17
	Sampl	Sample No. 4			Sample	No. 5			Sample	No. 6	
Cycles	No.	of Visible Wires Broken	s Broken	Cycles	No. of Vi	of Visible Wires	s Broken	Cycles	No. of Vi	Visible Wires	s Broken
completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G	completed	Pulley E	Pulley F	Pulley G
26,000	2	4	3	26,000	5	1	9	20,000	0	2	3
31,000	2	7	ተ	31,000	9	4	11	25,000	1	9	7
50,000	9	12	5	35,000	8	7	15	30,000	2	7	8
								35,000	3	8	10
***************************************								000 07	7	13	11

## PERCENTAGE REDUCTION IN STRENGTH DUE TO WORN AND BROKEN WIRES

Test Type No.	Sample No.	Pulley No.	No. of Visible broken Wires	Breaking Load (Undamaged Section) 1bf	Breaking Load (Worn Section) 1bf	Percentage Reduction of Strength 1bf
5	2	E F G	8 16 1	1859	1812 1702 1837	2.52 8.44 1.15
	4	e F G	11 13 8	1848	1781 1747 1740	3.62 5.46 5.84
	5	e F G	3 14 14	1857	1830 1635 1736	1.45 11.95 6.52
6	3	e F	5 12 1	1830	1799 1702 1714	1.69 6.99 6.33
	5	e F G	13 8 11	1832	1774 1698 1841	3.16 7.31 0
8	1	100円	14 10 17	1864	1514 1676 1561	18.77 10.08 16.25
	2	e F G	21 10 14	1864	1590 1707 1644	14.69 8.42 11.80
	3	ef	10 12 10	1823	1658 1624 1723	9•05 10•91 5•48
	4	e F G	21 8 20	1850	1646 1714 1664	11.02 7.35 10.05
	5	E F G	11 12 10	1859	1707 1534 1707	8.17 17.48 8.17
	6	3 <b>4</b> G	7 17 6	1859	1696 1702 1705	8.76 8.44 8.28

#### PERCENTAGE REDUCTION IN STRENGTH DUE TO WORN AND BROKEN WIRES

Test Type No.	Sample No.	Pulley	No. of Visible Broken Wires	Breaking Load (Undamaged Section) 1bf	Breaking Load (Worn Section) 1bf	Percentage Reduction of Strength 1bf
9	6	E F G	7 16 2	1855	1848 1810 1846	0.37 2.42 0.48
10	2	e F G	4 12 4	1873	1568 1801 1711	16.28 3.84 8.64
	3	E F G	8 7 12	1837	1814 1734 1792	1.26 5.60 2.44
	6	e F	12 7 9	1875	1725 1812 1752	8.0 3.36 6.56
13	2	e F G	11 12 5	1864	1738 1297 1725	ნ∙75 30•41 7•45
	3	e f	3 13 6	1859	1774 1785 1810	4.57 3.98 2.63
	4	E F G	9 12 11	1866	1819 1465 1749	2•51 21•48 6•27
	5	e p	6 7 21	1839	1781 1684 1664	3.20 8.42 9.51
14	2	e F G	6 13 9	1857	1823 1835 1850	1.83 1.18 0.37
	3	e F G	6 20 5	1846	1859 <b>*</b> 1758 1850	0 4.76 0
	4	e F G	14 14 10	1857	1642 1714 1781	11.57 7.7 4.09
	5	E F G	6 7 17	1859	1823 1826 1756	1•93 1•77 5•54
<b>4</b> D <sub>0</sub> P	6 roke in	E F G	14 12 16	1864	1684 1606 1593	9.65 13.84 14.53 Continued

#### PERCENTAGE REDUCTION IN STRENGTH DUE TO WORN AND BRUKEN WIRES

Test Type No.	Sample No.	Pulley No.	No. of Visible Broken Wires	Breaking Load (Undamaged Section) 1bf	Breaking Load (Norn Section) 1bf	Percentage Reduction of Strength 1bf
15	4	E F G	5 6 14	1846	1855 1859 1767	0 0 4•27
16	1	EFG	6 15 16	1864	1814 1711 1763	2.68 8.20 5.41
	2	E F G	5 11 13	1852	1796 1644 1779	3.02 11.23 3.94
	3	E F G	14 5 15	1864	1781 <b>*</b> 1781 <b>*</b> 1855	4•45 4•45 0•48
	4	E F G	18 3 11	1868	1781 1866 1879	4•65 0•10 0
	5	E F G	11 21 12	1861	1702 1756 1770	8 • 54 5 • 64 4 • 88
	6	EFG	8 14 15	1864	1781 1747 1788	4.45 6.27 4.07
19	1	e P	11 2 15	1861	1420 1689 1313	23.69 9.24 29.44
	2	e F G	17 1 14	1841	1734 1868* 1749	5.81 0 4.99
	3	e F G	6 2 13	i852	1613 1510 1028	12.90 18.46 44.49
	4	e F C	16 2 8	1852	1590 1702 1615	14 <b>.1</b> 4 8 <b>.</b> 09 12 <b>.</b> 79
	5	e F G	11 6 12	1852	1752 1761 1548	5•39 4•91 16•41

\*Rope Broke in Grips

TABLE 29 Continued

#### FERCENTAGE REDUCTION IN STRENGTH DUE TO WORN AND BROKEN WIRES

Test Type No.	Sample No.	Pulley No.	No. of Visible Broken Wires	Breaking Load (Undamaged Section) 1bf	Breaking Load (Worn Section) 1bf	Percentage Reduction of Strength 1bf
24	2	E F G	12 5 6	1859	1653 1792 1846*	11.12 3.61 0.69
	5	E F G	14 2 5	1868	1788 1875 1841	4•28 0 1•44
25	3	e f	10 16 14	1857	1794 1828 1832	3•39 1•45 :•34
26	1	efc	.8 8 15	1850	1743 1734 1711	5.78 6.27 7.51
	2	e f	3 13 6	1855	1720 1790 176 <b>7</b>	3.50 4.74
	3	e f	15 8 6	1859	1754 1763 1799	5.64 5.16 3.22
	4	F G	12 10 16	1855	1785 1745 1662	3•77 5•92 10•40
	5	E F G	15 7 10	7C35	1767 1743 1848	4.74 6.03 0.37
	6	E F G	15 15 9	1848	1870 1779 1859*	0 3,73 0
27	1	e P	15 5 18	186ଖ	1763 1763 1575	5.62 5.62 15.68
	2	E F G	7 6 15	1868	1832 1817 1714	1.92 2.73 8.24
	3	E T G	9 6 17	1841	1575 1770 1732	14•44 3•85 5•92

\*kope Broke in Grips

TABLE 29 Continued

TEST TYPE 1

ROPE TENSION 140 15, PULLEY DIAMETER 2.25 INCHES. SPEED 100 CYCLES/MINUTE

			Measure	d Exten	sion, I	nch		
Cycles Completed			Sa	mple Nu	mbers			
	1	2	3	4	5	6	7	8
22,000	0.107			0.096				
25,000		0.102	0.102		0.122	0.100	0.136	0.095
30,000	0.115			0.105			_	
35,000	0.140	0.127	0.127	0.115	0.151	0.120	0.149	0.115
45,000	0.149	0.141	0.139	0.131	0.166	0.120	0.150	0.136
55,000	0.167	0.150	0.143	0.137		0.142	0.173	0.137
60,000				0.139				
65,000		0.154	0.166		0.184	0.150	0.180	0.157
70,000	0.181			0.176				
75,000		0.158	0.173		0.186		0.191	0.169
85 <b>,</b> 000		0.178	0.185		0.203	0.170	0.193	0.180
95,000		0.182	0.193		0.207	0.175	0.195	0.182
105,000		0.191				0.179	0.210	
107,900								0.191
115,000							0.230	
117,000			0,213					0,212
126,000			0.221				i	
138,000	•	}	0.223					0.223
146,000		i				0.190	0.242	
148,000			0.242	}				

Numbers of Cyclica completed, rounded off to nearest 1000.

TEST TYPE 10

ROPE TENSION 140 16. PULLEY DIAMETER 2.50 INCH. SPEED 100 CYCLES/MINUTE

		E	xtensio	n, Inch		
Cycles Completed		<b>X</b> easu	red Sam	ple Num	bers	
	1	2	3	4	5	6
30,000 40,000 45,000 58,000 65,000 80,000 90,000 90,000 100,000 105,000 115,000 125,000 135,000 145,000	0.100 0.132 0.148 0.174 0.177 0.185	0.105 0.135 0.142 0.162 0.167	0.123 0.144 0.166 0.177 0.182 0.202	0.095 0.129 0.144 0.160 0.176 0.181	0.214 0.252 0.262 0.266 0.274	0.129 0.169 0.176 0.179 0.203 0.207
150,000 160,000 170,000		0.214	0.207			0.218

Numbers of cycles completed rounded off to nearest 1000.

ROPE TENSION 140 1b. PULLEY DIAMETER 2.75 INCHES. SPEED 100 CYCLES/MINUTE

	Measured Extension, Inch							
Cycles Completed	Sample Numbers							
	1	2	3	4	5	6		
100,000	0.177			0.173				
150,000 160,000	0.201	0.185	0.172	0.217	0.200	0.165		
250,000 251,000	0.250			0.248				
260,000	م مذه	0.210	0,204		0.223	0.181		
320,000 400,000	0.265	0.250	0.230	0.265	0.259	0.222		
401,000 427,000	0.281	0.257		0.283	0.269			
438,000 500,000	0.295			0.298	·	0.232		
550,000 601,000			0:256 0:271					

TABLE 32
TEST TYPE 4

ROPE TENSION 240 1b. PULLEY DIAMETER 2.25 INCHES. SPEED 100 CYCLES/MINUTE

		Measur	ed Exte	nsion,	Incaes	
Cycles Completed		1				
-	1	2	3	4	5	6
11,000				0.160		
15,000	0.137	0.123		0.187	0.130	0.154
20,000	0.143	0.125	0.151			0.159
25,000		_		0.203	0.147	
30,000		0.169	0.173		0.167	_
31,000	0.179					0.198
34,000				0.232		
37,000		_	0.174			
40,000		0.187				
41,000				0.233		
43,000	0.190					0.202
50,000		0.200				

Numbers of cycles completed rounded off to nearest 1000

ROPE TENSION 240 1b. PULLEY DIAMETER 2.50 INCHES. SPEED 100 CYCLES/MINITE

	Measured Extension, Inch Sample Numbers						
Cycles Completed							
-	1	2	3	4	5	6	
15,000	0.132			0.107			
20,000	0.150		0.400	0.128		0.050	
30,000 40,000	0.177	0.194	0.188	0.142	0.193	0.250	
45,000	0.218			0.174			
46,000			0.225			0.280	
60,000		0.230			0.225		
61,000	0.231		0.259	0.196		0.307	
76,000	0.243	0.283		0.215	0.084		
81,000	0.258	0.203		0.220	0.284		

TABLE 34
TEST TYPE 22
ROPE TENSION 240 1b. PULLEY DIAMETER 2.75 INCHES. SPEED 100 CYCLES/MINUTE

	Ueasured Extension, Inch						
Cycles Completed	Sample Numbers						
-	1	2	3	4	5	6	
30,000				0.177			
40,000	0.253		0.184	0.193			
45,000		0.168	·		0.178	0.198	
52,000				0.215			
60,000		0.182	0.215		0.210	0.225	
65,000	0.287		-	0.235			
75,000		0.208		0.250	0.229		
80,000	0.311					0.239	
82,000				0.258			
90,000			0.257				
95,000	0.339						
100,000						0.258	
110,000	0.351						
120,000			0.287				
125,000	0.374						
130,000			0.305	ĺ			
148,000			0.321				

Numbers of cycles completed rounded off to nearest 1000

ROPE TENSION 360 1b. PULLEY DIAMETER 2.25 INCHES. SPEED 100 CYCLES/MINUTE

	Extension, Inch								
Cycles Completed		Measured Sample Numbers							
	1	2	3	4	5	6			
8,000			0.173			0.158			
9,000		0.155			0.176				
10,000	0.149			0.172		į			
12,000						0.193			
13,000	0.162	0.172		0.175	0.178	ĺ			
17,000	0.185	0.213			0.232				
18,000			0.245	0.210		0.221			
26,000			0.256			0,233			
31,000			0.295			0.268			

TABLE 36

TEST TYPE 16

ROPE TENSION 360 1b. PULLEY DIAMETER 2.50 INCHES. SPEED 100 CYCLES/MINUTE

Cycles Completed	Measured Extension, Ench						
	Sample Numbers						
	1	2	3	4	5	6	
10,000	0.172	0.188	0.191	0.166	0.189	0.194	
15,000	0.180	0.221	0.226	0.196	0.222	0.220	
20,000	0.207		0.237	0.217		0.234	
21,000	Ť	0.260			0.266		
25,000	0.249		0.276			0.273	
26,000		0.265			0.267		
30,000	0.256					0.288	
31,000		0.305			0.306		
35,000	0.270					0.300	
37,600		0.314					

ROPE TENSION 360 1b. PULLEY DIAMETER 2.75 INCHES. SPEED 100 CYCLES/MINUTE

		Measu	red Ext	ension,	Inch	
Cycles Completed						
	1	2	3	4	5	6
18,000		0.216			0.253	
20,000	0.240		0.269	0.226		0.225
24,000		0.240			0.284	
26,000	0.276		0.272	0,284		0.232
31,000		0.301			0.336	
32,000	0.310			0.308		0.267
33,000			0.313			
37,000		0.314			0.353	
40,000			0.332			
43,000			0.339			
44,000		0.323			0.369	1
45,000		0.331	0.368		0.380	

Number of cycles completed rounded off to nearest 1000

TABLE 38

TEST TYPE 25

### ROPE TENSION 140 1b. SPEED 100 CYCLES/MINUTE

Number of Cycles Completed	Frequency of Measured	Extension Values Recorded Inch			
•	Extension Values	<b>Minimum</b>	Maximum	Average	
0 to 22,500 22,500 to 27,500 27,500 to 32,500 32,500 to 37,500 37,500 to 42,500 42,500 to 47,500 47,500 to 52,500 52,500 to 57,500 57,500 to 62,500	2 5 4 8 4 9 0 7 4	0.096 0.095 0.095 0.115 0.105 0.120 0.137	0.107 0.136 0.115 0.149 0.214 0.166 0.173 0.167	0.101 0.107 0.104 0.131 0.143 0.138 0.150 0.148	
62,500 to 67,500 67,500 to 72,500 72,500 to 77,500 77,500 to 85,000 85,000 to 95,000 95,000 to 105,000 105,000 to 137,500 137,500 to 162,500 162,500 to 187,500 187,500 to 225,000 225,000 to 325,000 325,000 to 375,000 375,000 to 425,000 475,000 to 525,000 525,000 to 675,000	10 2 5 5 9 9 13 15 2 0 5 2 0 6 3 3 1	0.135 0.176 0.158 0.142 0.162 0.173 0.181 0.165 0.214 0.222 0.265	0.252 0.181 0.186 0.262 0.266 0.274 0.230 0.242 0.225 0.283 0.265 0.283 0.269 0.298	0.169 0.178 0.175 0.183 0.190 0.190 0.199 0.205 0.219 0.254 0.265 0.253 0.283 0.271	

TEST TYPES 4, 13 AND 22 ROPE TENSION 240 16. SPEED 100 CYCLES/MINUTE

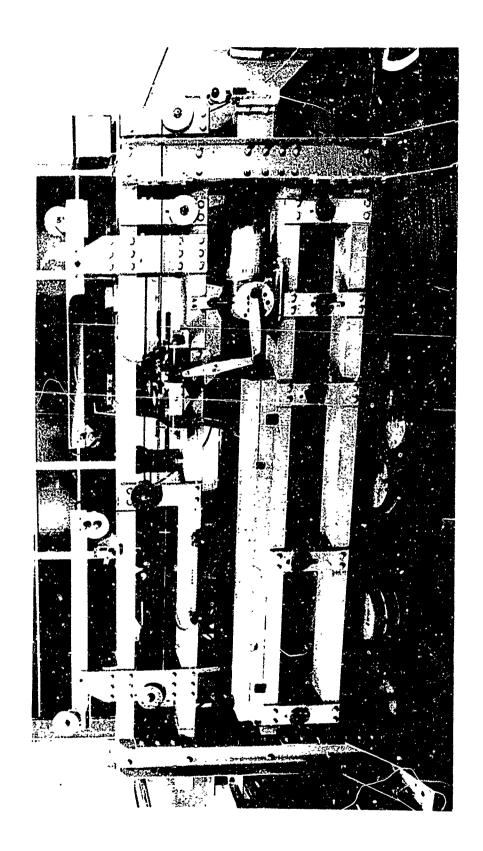
NUMBER OF CYCLES COMPLETED	FREQUENCY OF MEASURED BXTENSION VALUES	EXTENSION VALUES RECORDED INCH MINIMUM   MAXIMUM   AVERAGE			
			<del></del>		
0 to 12,500	4			0.160	
12,500 to 17,500	7	0,107	0.187	0.139	
17,500 to 22,500	6	0.125	0.159	0.142	
22,500 to 27,500	2	0.147	0.203	0.175	
27,500 to 32,500	10	0.142	0.250	0.182	
32,500 to 37,500	2	0.174	0.232	0.102	
37,500 to 42,500	7	0.184	0.253	0.205	
42,500 to 47,500	7 9 2	0.168	0.280	0.204	
47,500 to 52,500	9	0.200	0.215	0.208	
52,500 to 57,500	0	0.200	0.217	0.200	
57,500 to 62,500	10	0.182	0.307	0.228	
62,500 to 67,500	2	0.235	0.287	0.261	
67,500 to 72,500	ō	رردده	0520;	0-201	
72,500 to 77,500	5	0.208	0.250	0.229	
77,500 to 82,500	5 7	0,239	0.311	0.265	
82,500 to 87,500	ó	6,2,7	0.011	0.20,7	
87,500 to 92,500	1	<u> </u>		0.257	
92,500 to 97,500	4	ĺ		0.339	
97,500 to 112,500	2	0.258	0.351	0.304	
112,500 to 112,500	<b>~</b>	062,0	וענייי	00,004	
137,500	3	0.287	0.374	0.322	
137,500 to		0.201	U+)14	00,22	
162,500	1			0•321	

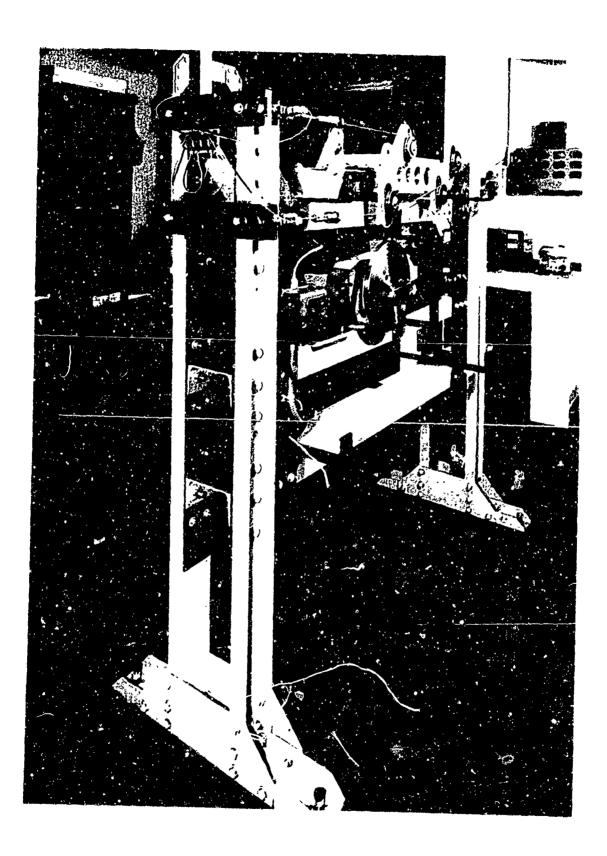
TEST TYPES 7, 16 AND 25

# ROPE TENSION 360 16. SPRED 100 CYCLES/HINUTE

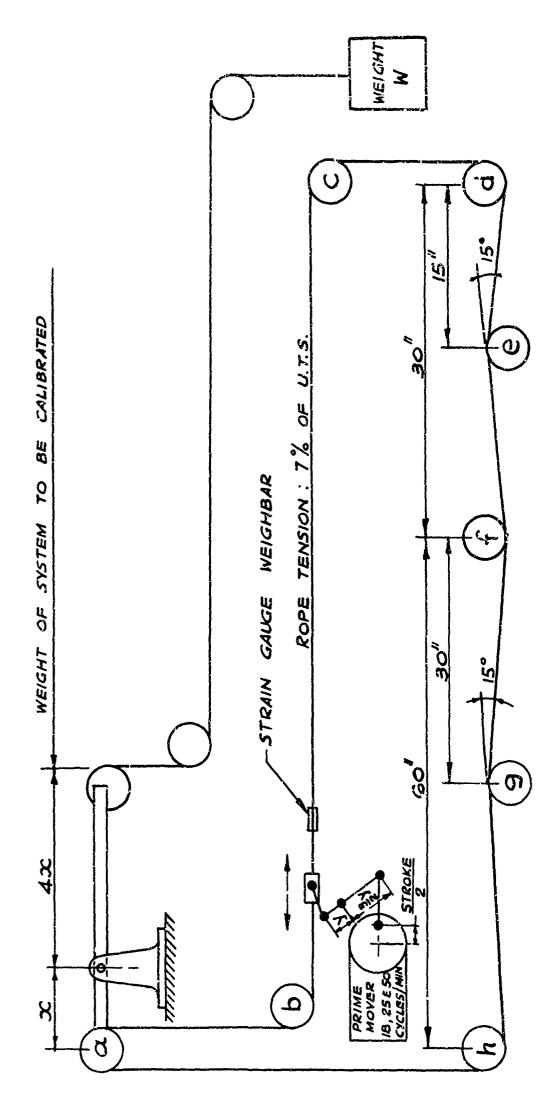
ming in the manufacture of the second of the

NUMBER OF CYCLES COMPLETED	Frequency of Measured	EXTENSION VALUES RECORDED INCH			
UMPISIED	EXTENSION VALUES	MINIMUM	HUMIXAM	AVERAGE	
0 to 12,500	13	0.149	0.194	0•175	
12,500 to 17,500	12	0.162	0.226	0.200	
17,500 to 22,500	16	0.185	0.269	0.232	
22,500 to 27,500	12	0.232	0.284	0.266	
27,500 to 32,500	9	0.256	0.310	0.293	
32,500 to 37,500	7	0.267	0.353	0.304	
37,500 to 42,500	1	[		0.332	
2,500 to 47,500	3	0.323	0.369	0.344	
47,500 to 52,500	3	0.331	0.380	0.360	





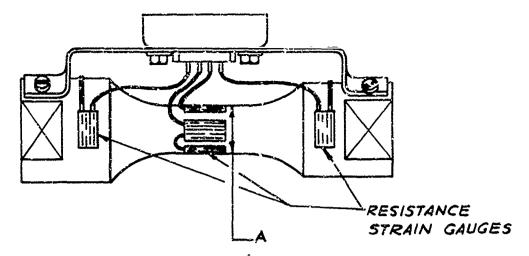
PHOTOGRAPH B



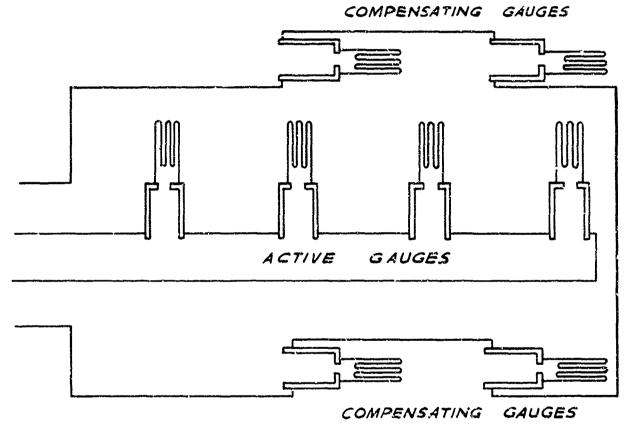
WEIGHT W = TOTAL WEIGHT L.E. WEIGHT OF SYSTEM + WEIGHTS ADDED NOTE :

DIAGRAM

5/3



### STRAIN GAUGE WEIGHBAR



### WIRING DIAGRAM

CROSS SECTION AREA AT A VARIES TO GIVE MAX. LOAD RANGES OF 200, 500 & 1,000 lbf GAUGES SECURED WITH EPOXY RESIN ADHESIVE AND WATERPROOFED WITH AN EPOXY RESIN COATING.

EACH GAUGE HAS 110 OHINS NOMINAL RESISTANCE.

F1G 3. REDUCTION IN STRENGTH PERCENTAGE REDUCTION IN STRENGTH AFTER O ENDURANCE TESTING PERCENTAGE 8 6 0 0 8 0 φ 

NO OF VISIBLE WIRES BROKEN.

FIG 4

TURNBUCKLE CONNECTING 8-ROPES-RECIPROCATING -DRIVE WHEEL WITH VARIABLE WEIGHBAR TO GRIPS UNDER TEST PULLEY CARRIAGES STROKE SETTINGS. 3 GROOVE DIA. EACH CARRYING LENGTH OF STROKE 4 SETS OF PULLEYS ANCHOR SCREW-COARSE TENSIONING OF CABLE STRAIN GAUGE WEIGHBAR MONITORING ROPE TENSION DURING TEST MOYOR STARTER-0 0 MOTOR SPEED CONTROL-CYCLING SPEEDS VARIABLE BETWEEN
25 AND 100 CYCLES/HMF CARRIAGE WAYS -15 INS LEOPE TENSION : 7%. 12%. 18% CORRECT ROPE ANGLE ENSURED BY GAUGING DIME O WHICH VARIES AS THE ROPE DIA. OF SPECIFIED MINIMUM TENSILE BREAKING LOAD. LOCATING SLOTS TO ACCOMMODATE VARIOUS PULLEY DIAMETERS. LO CHS.

THIRD ANGLE PROJE

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